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THE

MEDICAL JOURNAL OF AUSTRALIA

VOL. I.—10TH YEAR. SYDNEY: SATURDAY, APRIL 28, 1923. No. 17.

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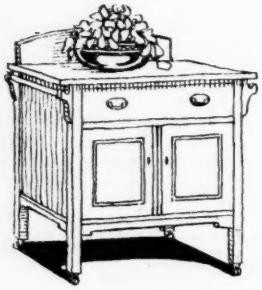

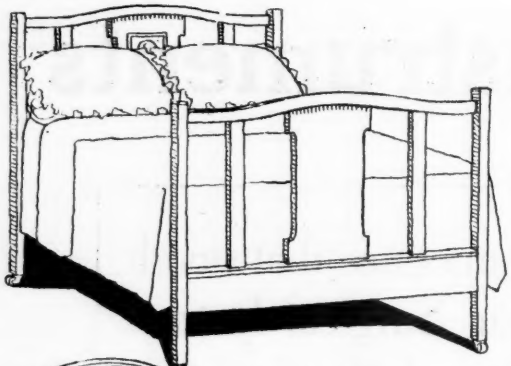

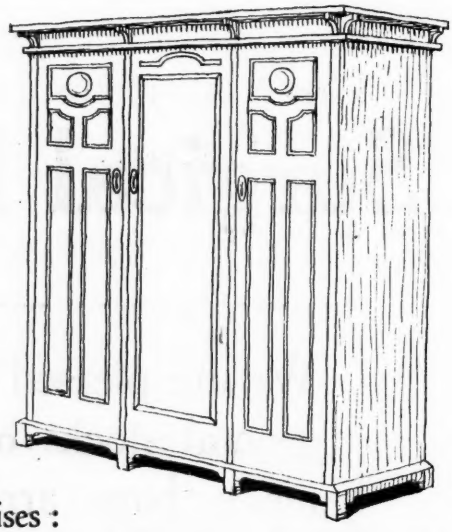

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THE MEDICAL JOURNAL OF AUSTRALIA

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Table of Contents

ORIGINAL ARTICLES— PAGE.

"Radium Therapy: Experimental Research Work in, Including Death, Retardation of Growth, Prolongation of Life, Determination of Sex, Sterilization and Artificial Parthenogenesis Reproduction Without the Male," by HERMAN LAWRENCE, M.R.C.P. 463

"A Pioneer Australian Surgeon and His Times: Part II.," by NORMAN J. DUNLOP, B.A., B.Sc., M.B., CH.M. 472

REPORTS OF CASES—

"Bilateral Detachment of the Retina in Nephritis of Pregnancy; Re-Attachment of Retina," by MARK GARDNER, M.C., M.D. 477

REVIEWS—

Recent Advances in Bio-Chemistry 477
Industrial Hygiene 478
Surgical Practice 478
Puerperal Sepsis 478

LEADING ARTICLES—

Mental Defect and Delinquency 479

CURRENT COMMENT— PAGE.

The Control of Leprosy 480
The Treatment of Syphilis in Pregnant Women .. 481

ABSTRACTS FROM CURRENT MEDICAL LITERATURE—

Therapeutics 482
Urology 483

BRITISH MEDICAL ASSOCIATION NEWS—

Scientific 484
Notices 485
Nominations and Elections 485

UNIVERSITY INTELLIGENCE—

The University of Sydney 485

CORRESPONDENCE—

The Use of the Tooth Brush 486

BOOKS RECEIVED 486

MEDICAL APPOINTMENTS 486

MEDICAL APPOINTMENTS VACANT, ETC. 486

MEDICAL APPOINTMENTS: IMPORTANT NOTICE 486

DIARY FOR THE MONTH 486

EDITORIAL NOTICES 486

RADIUM THERAPY.[1]

EXPERIMENTAL RESEARCH WORK IN, INCLUDING DEATH, RETARDATION OF GROWTH, PROLONGATION OF LIFE, DETERMINATION OF SEX, STERILIZATION AND ARTIFICIAL PARTHENOGENESIS REPRODUCTION WITHOUT THE MALE.

BY HERMAN LAWRENCE, M.R.C.P. (EDIN.) ETC.,
Honorary Dermatologist, Saint Vincent's Hospital, Melbourne; Consulting Dermatologist, Queen Victoria Hospital.

My paper this evening is chiefly to show the results I have obtained by the influence of radium upon the metamorphosis of insect life. I will, however, also describe some cases treated by radium therapy which are of interest in connexion with the experiments.

Most of my experiments have been carried out with the *Bombyx mori* or the common silk-worm moth. The natural history of this moth is well known to all of you, but I might just mention one or two points in connexion with its life history.

Starting with the moths—the moths are short lived, only living a few days. The male moth is smaller and more active than the female. The moths, male and female, occur in about equal numbers. Moths die soon after the eggs are deposited. When the eggs are laid, they are white or pale yellow, then, if they have been fertilized, the eggs pass through certain colour changes within a day or two of being laid, changing to orange, pink and then to slate blue colour. If the eggs are not fertilized, they do not go through these colour changes, but remain yellow and sooner or later shrivel up. In unfertilized eggs there are occasionally a few eggs which apparently pass through certain colour changes, becoming a speckled blue colour; but only a very few eggs undergo such changes and, of course, never hatch. Likewise in cases of true fertilization there are occasionally a few eggs here and there which fail to go through the colour changes, indicating they have missed becoming fertilized. In Australia the eggs laid in December remain as eggs until the spring of next year; if the weather is fine and warm they begin to hatch about September, generally a little too early for the white mulberry leaves and so one has to start feeding them upon lettuce.

When the eggs hatch, the grubs or larvæ are of a dark colour and about four millimetres (one-sixth of an inch) in length. They exist as grubs if the weather is favourable for about six to eight weeks, when they begin to spin a cocoon and later turn into a chrysalis; they remain in the chrysalis stage for about three weeks and then emerge as moths.

My experiments with radium upon these insects have been going on for ten years continuously. I mean by that the insects for ten generations have never been out of the influence of radium radiations and there is little doubt that the great changes which have taken place in the natural life of these insects, is due to the continued exposure to radium radiations.

My first experiments were carried out for the purpose of learning the value therapeutically of the radium radiations applied under different conditions. For instance, I found that if the ova of the moth were exposed to the influence of radium, ten milligrammes (pure radium bromide), four millimetres (one-sixth of an inch) distance and with one layer of lint and mica interception, the ova were

[1] Read at a meeting of the Victorian Branch of the British Medical Association on March 7, 1923.

so affected that, though fertilized, they were destroyed and could not hatch. Other experiments, in which aluminium or leaden interceptors were used, showed the great value of the high velocity β electrons from radium *C* (which are not present in the X-rays).

During these experiments I found that under the influence of the radium the natural life history of the insect was becoming altered, so I then continued my experiments with a view to finding out what further effects might be produced upon the metamorphosis of the insect's life.

Radium is a metal which is radio-active, that is, it is undergoing spontaneous disintegration. There is no method known to scientists by which this process of disintegration can be prevented.

It is not affected, for instance, by extreme heat, cold, pressure and the like, but the emanation, a radio-active gas, may be removed from the radium substance, leaving the metal more or less inert for a few days, though the disintegrating process continues as a fresh supply of the emanation gas is formed, the preparation gradually recovers its activity.

Scientists tell us that in the process of disintegration of radium certain results obtain, *viz.*, the production of α particles, β electrons and γ rays.

It is estimated that the power expended in bringing about certain stages in this disruption of the radium particle is equal to that developed by a tube voltage of one or two million volts and as the greatest tube voltage scientists have yet been able to use in the production of

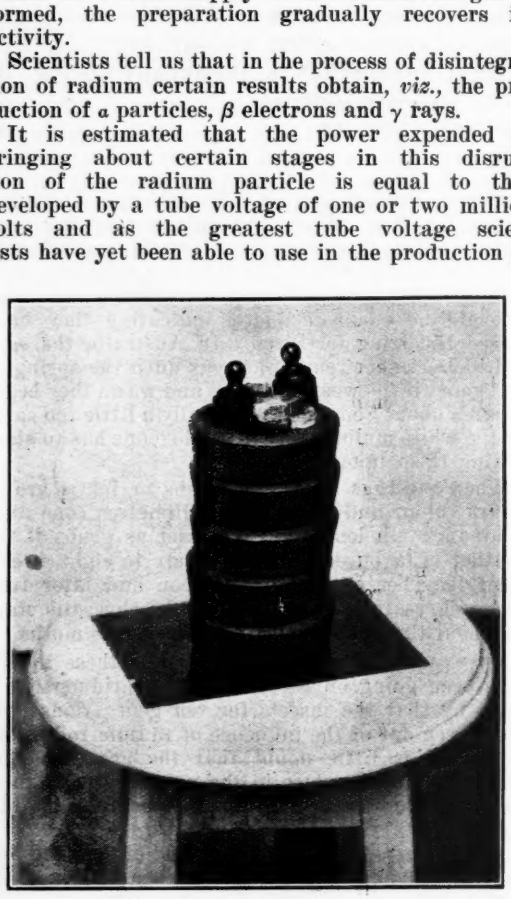

FIGURE I..

Five Four-Pound Iron Weights Placed One Upon the Other, making a column of iron 16.5 centimetres (6½ inches) in height. One hundred milligrammes of radium bromide are placed on the top of the column and a key and coin are placed on a photographic plate beneath the column.

FIGURE I..

Skiagram of the Key and Coin, showing the penetrating power of γ rays of radium through the column shown in Figure I..

X-rays is about 250,000 volts, it is seen that the initial force or power in the production of α particles, β electrons and γ rays is about four to eight times greater than that of the power used in the production of the most penetrating X-rays yet produced. In fact, the γ rays of radium are 3.5 times more penetrating than the most penetrating X-rays yet produced. It appears α particles are emitted from radium at about the rate of 34,000,000 to the second from one milligramme of pure radium bromide. These particles have mass and carry a charge of positive electricity. There are different varieties of α particles, but as their power of penetration is so insignificant, they are seldom made use of in the treatment of disease. When radium is kept in glass tubes, the α particles are absorbed into the glass and take part in turning the glass a violet colour. However, I have a radium treatment specimen which, if it does not give off α particles, at any rate emits the softest of the β electrons. This specimen was a glass tube containing ten milligrammes of pure radium bromide; it had accidentally been thrown into the fire; the glass melted and some of the radium no doubt escaped, but the greater part of it was caught up in the melted glass and some appears to be in the superficial portion of the glass. This specimen is kept in cotton wool in order to prevent injury to the specimen. This specimen is especially mentioned in my experiments in connexion with artificial parthenogenesis. It is called No. 16. All my specimens are numbered, in order that my assistants may be able to carry out treatments and experiments according to instructions. The numbers refer to the order in which I obtained the specimens. No. 1 is the first specimen, obtained in 1903, and No. 25 the last specimen, recently obtained from America. It may be of interest here to mention two patients treated with No. 16 radium. They were sent by eye specialists

with the diagnosis of papillomata. In each case the growth was situated on the front of the eye, interfering with vision. It was suggested to try radium; otherwise enucleation of the eye would probably be necessary. I will enumerate the cases I am reporting in this paper treated by radium by the letters of the alphabet, so we will call these cases A and B.

A is the patient mentioned in my book, "Radium Therapy" (page 125), and sent to me by Dr. Ed. Ryan. B was sent by Dr. Shorney, of Adelaide. In both the new formation disappeared and the sight was recovered and operation avoided. In both these cases No. 18, another ten-milligramme specimen, was used as well as No. 16. No 16 was applied as near as possible to the growth without touching it for twenty minutes at a time and No. 18 was similarly applied for fifteen minutes at a time, the idea being to get intense radiations to act locally and with as short a treatment as possible, as, of course, the more penetrating β electrons and γ rays are penetrating the eyeball at the same time as the treatment is being carried out.

The β electrons, particles of negative electricity, are emitted from radium probably at about the same rate as the α particles. There are many varieties of β electrons, which have varying degrees of penetrability. It is important to remember that these α particles and β electrons are not present in X-rays, so that patients A and B just mentioned could not be similarly treated by the X-rays. It is not uncommon for X-ray enthusiasts to state that the two terms "X-rays" and "radium rays" are synonymous; this statement, though perhaps superficially true, if referring only to the γ rays of radium (which, like X-rays, are electro-magnetic waves, the γ waves, however, being very much the shorter) is apt to be misleading unless the fact is mentioned that no high velocity β electrons of any kind are present in the X-rays. Of course, it is well known that impact of X-rays on tissue or on any other form of matter ultimately results in the destruction of the X-rays and their replacement by electrons expelled from the matter struck, but the electrons so expelled are always slower and generally much slower than the β electrons from radio-active substances. Such β electrons derived from radium *C* play a most important part in the therapeutic efficiency of radium in the treatment of many conditions.

In a paper I read at the Australasian Medical Congress, Brisbane, 1920, I showed the great value of cross-fire treatment, in which radium specimens are used emitting high velocity β electrons and γ rays on the one hand and radium specimens giving γ rays only on the other hand, or filtered X-rays.

The radio-sensitivity of some pathological conditions is very high to this form of treatment. Large, subcutaneous, angiomatous nævi of the cheek, especially in babies, will disappear under this form of treatment, without producing any visible evidence of inflammation in the skin or mucous membrane.

I might here mention three cases of early epithelioma of the lip, which came under my care last year—Patients C, D and E. These patients were all elderly men. C had been operated upon for epithelioma of the lip sixteen years ago. The excision of the growth must have been very extensive, as the movements of the mouth showed that there was considerable shortening of the lower lip. The patient states that the growth removed was on the extreme right of the lower lip. The growth at this time was on the extreme left border of the lower lip and so right away from the scar of the previous operation.

Patient D states that a growth on the lower lip was removed by radium fourteen years ago. Here again the present growth was quite a distance from the site of previous treatment.

Patient E's condition was similar to that of Patient C. An epithelioma was removed by excision ten years ago and the new growth was right away from the scar formation of the previous operation.

In my reference to these cases I have purposely not used the term recurrence, because I consider the treatment in each case cured the disease entirely, but the patient, being predisposed to epithelioma of the lip, acquired the disease a second time, quite independently of the previous trouble and in no way as the result of any diseased tissue having been left behind. The patients were, of course, all elderly and the growths quickly disappeared under cross-fire treatment.

Another interesting case treated by this method is that of Patient F, who was sent to me by Dr. Brown, of Adelaide. When examined by Dr. A. L. Kenny, the patient had an epithelioma of the right vocal cord and the adjacent mucous membrane. There was also a hardness to be felt externally, corresponding to the position of the growth in the larynx. Dr. Kenny suggested scooping out a part of an intubation tube corresponding to the right vocal cord area and placing in this a tube of radium, which was to cross-fire with a radium specimen applied externally. A three hours' treatment was given in this way. No. 25 specimen (glass tube only) was placed in a scooped out area of an intubation tube as described, covered with thin indiarubber only, the rubber extending over the intubation tube to prevent any burning by secondary rays set up in the metal. Externally specimens No. 18, No. 21 ad No. 22 (fifty milligrammes) were applied, only γ rays being used. Under this method of cross-fire treatment, all evidence of disease disappeared and the patient is still quite well. It is two years since the last treatment was administered.

Lethal Effect of Radium on Moth Eggs.

Experiments 39 to 50 (1913) show that the ova of the *Bombyx mori* are generally destroyed when exposed to the influence of radium, if the filtration is only sufficient to cut out the α particles and the softest of the β electrons, in about one hour. Larvæ of the *Bombyx mori* only a few days old are killed under similar circumstances in about two to three hours. As the grubs become larger, the time of exposure to kill them has to be greatly increased. In these experiments No. 9 or No. 18 radium specimens were used, each of which specimens contain ten milligrammes of pure radium bromide.

Experiments also showed that a cross-fire of No. 9 and No. 18 for half an hour was more effective

than a one-hour application by either specimen. Experiments also showed that if the specimen were placed right on the ova, it would only kill about ten eggs, as they are ordinary placed by the moth, but if the specimen were set back four millimetres (one-sixth of an inch), twenty eggs would be destroyed. The importance of this diffusion of the β electrons and γ rays of radium should be taken advantage of in the treatment of early rodent ulcers.

Darier has drawn special attention to the lateral extension of the basal-celled epithelioma, which he considers is one of the reasons that makes the treatment of these conditions unsuitable for treatment by excision.

Dr. Flecker kindly exposed some ova similar to the ones I have just mentioned to the deeply penetrating X-rays. The dosage was equal to about ten erythema doses and so quite beyond therapeutical treatment; it was 200,000 volts, five milliampères, twenty centimetres from the anti-cathode, for four hours and twenty minutes. The filter comprised 1.3 millimetre of copper and one millimetre of aluminium. However, as is seen by the photograph, the eggs hatched freely, in spite of this tremendous dosage of X-rays (see Figure V.).

This experiment shows that X-rays and radium rays are not synonymous, if we include the high velocity β electrons from radium *C*.

I might here mention two patients treated by the radium with the radium specimens so arranged that only high velocity β electrons and γ rays were used (Patients G and H).

Patient G, female, over sixty years of age, was the first patient with basal-celled epithelioma (rodent ulcer) treated by radium in Australia (1903). The case is mentioned in a paper I read at the Australasian Medical Congress, Adelaide, 1905.

There was ulceration of the inner thirds of both eyelids of the right eye, ulceration on the side of the nose, extending up on the forehead, destroying

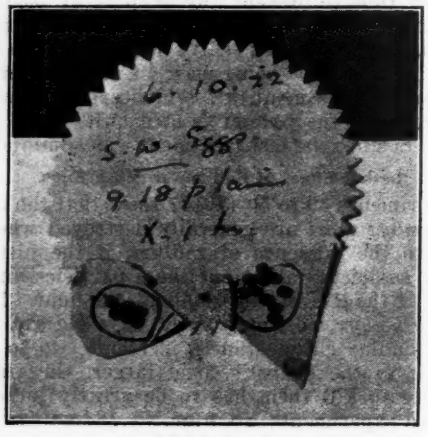

Figure III..

Ova of *Bombyx mori*, exposed to one hour cross-fire from radium specimens Nos. 9 and 18, plian. All the ova are destroyed; none has hatched.

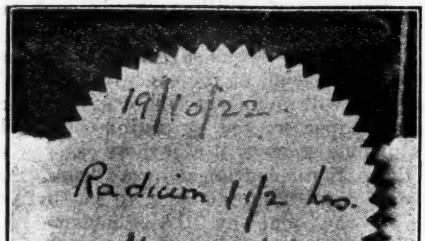

Figure IV..

Ova of *Bombyx mori*, exposed to one and a half hours from radium specimen No. 18, plain. Only one egg has hatched; it died in a few days.

the inner third of the right eyebrow and down on to the right cheek; a very extensive case. The whole condition healed up entirely with a cosmetic result, making it difficult to believe there had been any ulceration at all. This patient came to see me in 1918. The patient was still quite well and there had never been any relapse.

Patient H was suffering from squamous-celled epithelioma. The case is mentioned in my book, "Radium Therapy" (page 134). It is interesting to mention this case, as it is now eleven years since the patient was treated. She was over seventy years of age when she was brought to me by Dr. Deravin, as the growth situated on the back of the wrist was movable. I recommended excision. The growth was twice removed by surgical means, but as it returned after each operation, I applied radium therapy. The growth disappeared; at the same time I irradiated the glandular regions. In my book I said time alone will show if this treatment is successful.

The patient was brought to see me last year. The hand trouble had not returned; there was only the scar of the previous operation present. However, she had got three rodent ulcers upon her face. She was in a very weak state of health. Radium was applied and two of the rodent ulcers healed up in about three weeks' time, but one on the side of the nose, which was ulcerated, did not improve, the reason no doubt being that she was in such a feeble state of health that the tissues could not respond in a healing way to the radium treatment.

Retardation of Growth.

If the larvæ are exposed to radium, the exposure not being of sufficient strength to kill them, the growth of the larvæ is retarded and many of them die during the moulting stage.

When the seeds of plants are exposed to radium radiations, including the high velocity β electrons from radium *C*, retardation of growth takes place. But in none of my experiments carried out either

upon animal or vegetable life have I ever seen any evidence of stimulation of growth.

This supports the statement of Professor Simpson, of Chicago, that in his clinical experience of radium therapy he has failed to recognize any evidence of stimulating effects of radium treatment upon malignant growth. He also describes interesting experiments carried out *in vivo*, in which cancer nodules were treated by pitch blende, the strength of which is only one millionth of that of pure radium bromide; after some months the nodules were examined microscopically, but no evidence of stimulation was detected, only slight retrogression of the cancer tissue as compared with untreated nodules.

Figure VI. shows the results of exposing the seeds of turnips to radium and X-rays, compared with control or normally-grown seeds. C and D show the growth of turnips, retarded and deformed as a result of exposure of the seeds to radium as previously mentioned.

A and B appear almost similar, that is, there is practically no alteration in the growth of the seeds exposed to the X-rays, although the seeds had been exposed to a heavy dose of deeply penetrating rays, namely, 200,000 volts, five milliampères, twenty centimetres from the anti-cathode for two hours, passed through a filter of 1.3 millimetres of copper and one millimetre of aluminium.

Figure V..

Ova of *Bombyx mori*, exposed to a very heavy dose of X-rays. The ova are seen to have hatched freely in spite of the irradiation. The dose of X-rays was 200,000 volts, five milliampères for four hours and twenty-nine minutes, at twenty centimetres from the anti-cathode, the rays passing through a filter of 1.3 millimetres of copper and one millimetre of aluminium.

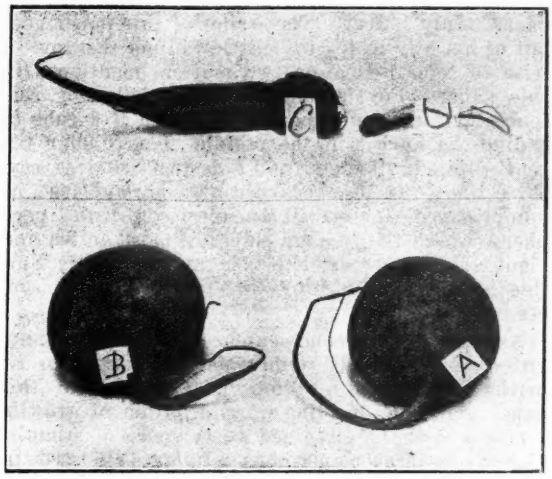

Figure VI..

A represents the normal growth of turnips, used as a control to experiments depicted in B, C and D. B represents the growth of turnips, the seeds of which were exposed to X-rays on September 25, 1922. (The same dose as was used in experiments on *Bombyx mori*, as shown in Figure V.). C and D depict the retardation of growth of turnips, the seeds of which were exposed to high velocity β electrons and γ rays from radium. The majority of the seeds were destroyed and no growth appeared.

The results of these experiments are not to depreciate in any way the value of X-rays as a therapeutical agent, but rather to show the importance of using the high velocity β electrons of radium *C* where practicable. The penetrating power of these β electrons is very small, but by using several specimens as a cross-fire, a considerable distance of growth can be treated in this way.

In Figure VII. you see the great effect of retardation of growth after the seeds have been exposed to radium under conditions as previously mentioned, whereas the plants grown from the seeds which had been exposed to X-rays, are even better than the control or normal plants. In this experiment the maize seeds had an exposure of two hours to soft X-rays.

The plants affected by the radium are not only dwarfed, but are deformed, some of the leaves taking on a tubular formation. In fact, the plants looked as if they had retrogressed to the prairie grass formation.

In this experiment, soft X-rays were applied, but Kroenig and Friedrich have shown the biological effects of soft and deeply penetrating X-rays to be practically the same. The following is taken from Kroenig and Friedrich's work:

> From the two experiments it follows that with the same dose and the same intensity, measured with the aluminium chamber, the unfiltered X-rays do not exert a more markedly pronounced stronger action on frog's spawn than the X-rays filtered through one millimetre of copper.
>
> We conclude from all the experiments that with the same dose measured with the aluminium chamber, the γ rays of mesothorium and radium filtered through 1.5 millimetres of brass, *plus* five millimetres of celluloid, possess a very much stronger biological action on the larvæ of frogs than X-rays filtered with one millimetre of copper.

A paper by Dr. E. H. Molesworth on "X-Ray Therapy" appeared in The Medical Journal of Aus-

TRALIA, July 1, 1922. The writer of this paper goes out of his way to try to belittle radium therapy. I wish to refer to one or two matters mentioned in this paper. For instance, the two following sentences: "It certainly means that, even if a tube of radium be buried in the middle of a tumour ten centimetres in diameter and a destructive dose, say, three times the dose regarded as a normal dose, be administered, there will be received at the periphery, where the tumour cells are most active and vigorous, only one-twelfth of a normal dose. Now this is more stimulating than destructive to cancer cells."

As regards the second sentence referring to stimulation of growth, I would refer the writer to remarks by Professor Simpson (Chicago) in this paper under the heading of retardation of growth. I may add that I obtained no evidence of stimulation in any of over one thousand plants the seeds of which had been exposed to all possible varieties of radiations from radium; the only results were death of the seeds or retardation of growth, according to the degree of exposure to radium to which the seeds had been exposed. As regards the writer's suggested method of treatment of tumour growth by radium, I will reply to that by quoting the following case:

Patient I, male, who was suffering from a recurrent sarcoma of the neck, was sent by a surgeon who stated that he had a few months previously removed a small round-celled sarcoma from the right side of the neck. The growth having recurred, he had again attempted operation, but had found the large blood vessels of the neck implicated and surgical procedure was therefore impossible.

On examination I found that there was a freshly stitched up incision about fifteen centimetres (six inches) in length on the right side of the neck. A tumour mass somewhat in the shape of a large sausage was present. Removing the stitches and making use of the same incision, Dr. Murray Morton buried tubes of radium in the growth so that cross-fire treatment would be obtained. Radium specimens were also placed in the dressing over the wound, which was partially sutured in order to get further cross-fire treatment. After twenty-four hours of such treatment the radium specimens were all moved a short distance and further treatment for twenty-four hours given. After the forty-eight hours, all the radium specimens were removed and the wound stitched up. In three to four weeks all evidence of tumour was gone and there was still no evidence of the growth in the neck twelve months afterwards. But I believe there was later on a recurrence in some other part of the body.

This method of treatment does not seem to coincide with the picture mentioned by the X-ray enthusiast.

It would appear also that, in the same writer's opinion, the range of effectiveness of the γ rays of radium is about one centimetre. This certainly differs widely from some writers upon the subject, who speak of six, eight or even ten centimetres as effective range of γ rays. The following case is interesting from this one-centimetre point of view:

Case J, female, had an inoperable sarcoma in the region of the right tonsil. The growth was so large that the patient was scarcely able to swallow. There was also a mass of growth under the right jaw. Radium tubes were applied to the upper part of the growth in the throat by passing some through the right nostril; tubes were also applied to the inner surface of the growth in the throat. Radium specimens were likewise applied behind the angle of the inferior maxilla on the right side and to the mass in the sub-maxillary space on the right side. All signs of the disease disappeared in three to four weeks and six months afterwards there was still no return of the growth. Unfortunately I have no further history of this case.

No tubes were buried in this case and I only mention it to show that one centimetre was hardly the limitation as regards the efficiency of the γ rays in this case.

The following report is of one of my patients who had been treated for inoperable malignant disease of the uterus at least five years ago:

Case K, female, was seen in consultation with Dr. Cairns Lloyd. On inspection a very extensive fungating growth of the cervix, with all the usual symptoms of cancer of the uterus was found. Radium therapy was applied; all signs of disease cleared up, the patient gained twelve kilograms (two stone) in weight and is still quite well. It is now five years since the radium treatment was applied.

Determination of Sex.

In 1913, when examining moths to see if the two kinds of larvæ (black and white) had anything to do with sex, I found that of one hundred and fifty-six moths examined for this purpose there were eighty females and seventy-six males, that is, the moths at that time occurred in almost equal numbers. Of late years, however, the great preponderance of males over females became evident and it was difficult to obtain sufficient females for experimental purposes. In fact, the present state of affairs for the present generation of moths is about five males to one female, that is, of one hundred and fifty-six months there are twenty-six females and one hundred and thirty males. This state of affairs appears to suggest that the radio-sensitivity of the males as regards their reproductive organs is much greater than that of the females (see Figures VIII. and IX.).

It would appear that, according to the gene theory in connexion with the development of the embryo, the gonad (tissues of reproduction) of the male are more radio-sensitive than the corresponding tissues of the female. And so when the nucleus of the microgamete of the male unites with the nucleus of the macrogamete of the female (in syngamy, the chromosome representing the hereditary factor, for the sex of the macrogamete is more powerful to act than the corresponding chromosome of the microgamete and, as this chromosome of the female in this insect determines the sex for a male, so the moths produced are all males.

In the human being we know that men working in an X-ray atmosphere, for example, men employed in the testing of X-ray tubes, become sterilized and in cases where these individuals are away for some time from these sterilizing conditions and so recover from their effects, their children appear to be males. I know of five children born under such circumstances and they are all males.

Prolongation of Life of Larvæ as Larvæ.

Kroenig and Friedrich do not appear to mention any evidence of prolongation of life of the larvæ of frogs.

In my experiments upon the larvæ of *Bombyx mori* on several occasions the larvæ have remained as larvæ for several weeks after the control larvæ have spun cocoons and become chrysalides and on

one or two occasions the control larvæ had reached the moth stage, laid eggs and died. Of course, in these cases the larvæ with their lives prolonged as larvæ never went through the natural process of metamorphosis and died as larvæ (see Figure X.).

Larvæ two weeks old exposed to radium rays and living as larvæ to twelve weeks, were retarded in growth and only consumed in the ten weeks about the same amount of food as the control larvæ do in the six weeks they continued to exist as larvæ.

The irradiated grubs are in a very irritable state and greatly resent normal grub crawling over them or even brushing up against them.

Two Varieties of Larvæ.

Whilst examining the larvæ from irradiated moths for signs of mal-development, I noticed that some of the grubs were marked differently to other grubs, the difference being in certain markings upon the head of the grubs. That these markings indicate distinct hereditary factors was shown by experiments in which moths developing from the grubs with one form of marking were mated together and moths from grubs with the different markings were also mated together.

For purposes of description I called these two varieties of grubs black and white. These distinctive markings do not become recognizable until the grub is about three weeks old. It occurred to me that this distinctive marking in the grubs might have some bearing upon the life of the insect from a eugenic point of view. The males and females among one hundred and fifty moths examined showed almost equal in number. There was also nothing to suggest any connexion with the different colour of the silk produced. The results of many experiments of mating moths from grubs with the similar markings and likewise with moths from grubs with dissimilar markings appear to suggest a definite effect upon the reproduction of the insects from a numerical point of view.

Figure VII..

This Picture Shows the Retarded Growth of Maize after Exposure to radium. Two small plants in the centre of the picture are deformed; some of the leaves are tubular. It suggests that the maize has retrogressed to prairie-grass formation. The large plant on the right reveals good growth of maize, although the seeds were exposed for more than two hours to X-rays without filtration. The plant on the left is a sample of normally grown maize.

Figure VIII.

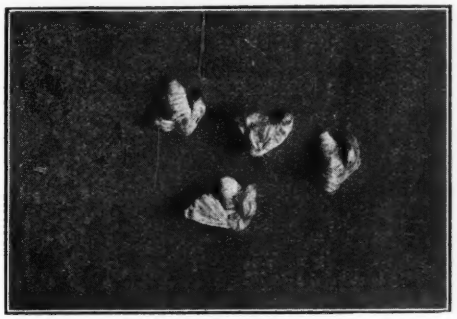

Figure IX..

Determination of Sex. Though normally the male and female moths occur in equal numbers, the result of continued exposure to radium is that there are now five males to one female.

Figure X..

This Grub Represents the Artificial Prolongation of Life. It lived as a grub to eighty days; the corresponding grubs had become moths, had laid eggs and had died.

The results of many experiments during the past eight years show that fifty-eight pairs of white produced 2,845 white and 293 black, making 3,138 grubs altogether. Fifty-eight pairs of black produced 1,171 white and 2,321 black, making 3,492 grubs altogether. Fifty-eight pairs of black and white produced 1,130 white and 1,011 black, making 2,141 grubs altogether.

Being interested in these two forms noticeable in the larvæ of the *Bombyx mori*, I likewise examined the grubs so common upon the vines and here again I found two distinct markings. For instance, the grub is really a dark or black grub with numerous light-coloured markings. When quite young there is no distinction noticeable in these markings,

but as the grub becomes about half grown, the light-coloured markings noticed in some grubs are white and the corresponding markings in other grubs are distinctly yellow. I suppose that moths derived experimentally from the grubs would give results similar to those obtained in the case of *Bombyx mori*.

I then examined the grubs of the Emperor moths, which are frequently found upon the pepper trees, and here again two forms of grubs were noticeable; a colour distinction was also noticeable only in the later stage of the grub's life.

In studying the *Demodex folliculorum* I have likewise found two forms of larvæ, but in this case the difference is a very definite one. In examining scrapings containing numbers of the *Demodekai* I have occasionally noticed the presence of tadpole or jelly-fish like organisms which I thought must be in some way connected with the *Demodex* itself. At last I came across on two or three occasions these peculiar amœboid-looking bodies actually turning into *Demodekai*. They are, of course, quite distinct from the recognized hexapod larvæ, described by Hurst and other biologists as the larval stage of the *Demodex*. Now, on looking up the earliest literature upon the subject, I found that in a paper read by E. Wilson (afterwards Sir Erasmus Wilson) at a meeting of pathologists in London on November 23, 1843, that this larval stage of the *Demodex* was not only described, but diagrams were also shown and Wilson claimed that it was an embryonic stage of the *Demodex*. He does not state that he had ever seen this body developing into a *Demodex*. However, literature of later dates upon the subject of the *Demodex* appears to have discarded altogether Wilson's suggestion of this embryonic stage in the metamorphosis of the *Demodex*. Wilson suggested that this form of larvæ developed into the long-bodied *Demodex*. My experience, however, shows that it developes into the short-bodied *Demodex*.

Sterilization.

Sterilization may be produced by irradiation in any stage of development of the *Bombyx mori*. However, the nearer the stage of development is to the moth stage, the greater is the certainty of producing sterilization; the amount of irradiation required to produce this effect increases accordingly.

Eggs when exposed to No. 18 radium screened with thick cardboard and two pieces of lint for one hour and a half may develope into moths and when these moths are mated, the eggs may be sterilized; occasionally no eggs are produced. But sterilization is not at all certain in these experiments upon the eggs.

However, Experiments 176 and 178 show definite sterilization of grubs four weeks old.

Ten grubs four weeks old were given an exposure to radium for twenty hours and another ten grubs were given a similar exposure, but the exposure was divided up into five hourly exposures, given on alternate days (fractional treatment).

All the grubs in this experiment were sterilized. The eggs of moths from these grubs, mated with control moths (whether the irradiated moth were a male or a female, made no difference), were all sterilized. In the grubs treated by fractional dosage the effect was greater, as two of the female moths did not produce any eggs at all.

Similar experiments with chrysalides in cocoons gave similar results. In this experiment No. 21 specimen in metal case was placed in the centre and the cocoons were placed on either side of it. Then No. 18 and No. 19 were placed upon each side of the cocoons, so that a cross-fire was produced between the γ rays from the tube in the centre with high velocity β electrons and γ rays from the specimens No. 18 and No. 19 were applied for twenty-four hours. All the moths developed from these chrysalides were sterilized. These experiments were carried out in 1917. The experiments with grubs were repeated last year (1922), but the grubs have lost their power of resistance to the effects of irradiation as they all died.

Experiment 245, carried out in 1917, was to determine the effect of X-rays on the sterilization of grubs. Sixty silk-worms, one week old, were given an exposure to X-rays from a Coolidge tube. The current used was five millampères, with a fifteen centimetre (six inch) spark gap. The rays were applied at a distance of twenty centimetres (eight inches) without protection for seven and a half minutes. Twenty of the silk-worms were placed in a box marked A. The other forty were given a second treatment as before and twenty of these grubs were put in a box marked B. The remaining twenty were given a third dose and placed in a box marked C.

The results were twenty imperfect moths in box A, with 748 grey (fertilized) and sixty yellow eggs. One hundred and thirty-one black and two hundred and twelve white silk-worms emerged, making three hundred and forty-three altogether.

Of the moths in box B, two died before spinning, two died after starting to spin, leaving sixteen moths. There were 964 grey and 159 yellow eggs. One hundred and two black and one hundred and twenty-six white silk-worms emerged, making two hundred and twenty-eight in all.

In box C three chrysalides died in cocoons, three died after spinning a few strands and two died before spinning. There were 118 grey and 309 yellow eggs. Twenty-three black and fifty-four white silk-worms emerged, making seventy-seven in all.

This experiment reveals the small power of X-rays to produce sterilization.

A very heavy dosage of rays was administered and the silk-worms were only one week old.

Artificial Parthenogenesis.

I should here refer to the changes which have taken place in the metamorphosis of these insects' lives, the result, no doubt, of their being bred for ten generations in an atmosphere continuously ionized by the presence of radium. For if an electroscope be charged with electricity, at any time, day or night, it would quickly become discharged owing to the ionized state of the air, due to the presence of radium. On several occasions I have introduced a new strain of silk-worms in order to prevent in-

breeding. The changes as compared with the conditions of affairs in the first years of the experiments are the following:

The larvæ die in great numbers, especially during moulting. A large number of the larvæ become chrysalides without spinning cocoons. A large number of moths die in the cocoons and also a great number fail to emerge from the chrysalis stage. Of the moths derived from the chrysalis stage without cocoons, a large number are deformed, almost wingless, some are large, apparently females, but fail to lay eggs and many of the eggs go through colour changes. As previously mentioned, the moths are chiefly of the male sex, in the ratio of five to one.

It is certain that these changes, which have come about gradually, are due to the influence of radium ionization, as at the beginning of the experiments, th eeggs exposed to radium or the young larvæ similarly treated gave similar results to those just described.

Many experiments were carried out at different times for the purpose of producing, if possible, fertilization without the male.

For instance, in one experiment radium specimen No. 21, containing 31.5 milligrammes of pure radium bromide in glass capsule only was suspended from the bottom of a medicine glass on the inside. This, of course, is luminous in the dark and so attracts the moths to it.

Four female moths were then placed under the medicine glass, a wooden match being placed under the edge of the glass in order to allow of free access of air. Under these conditions the glass was placed inside of a safe over night. The result of this experiment gave numerous orange-coloured eggs, which remained solid, but no eggs hatched. From later experience I would say the moths were over-exposed, as the bombardment with β electrons would be so great that, if the ova were fertilized, the later effect of the exposure would be to arrest fertilization.

If two moths mate so that normal fertilization takes place, such an exposure would prevent the eggs laid upon the second day going through the colour changes of fertilization and the eggs laid the first day, though going through the colour changes of fertilization, would not hatch later on, as they would be destroyed by the latent action of the irradiation.

However, by placing radium specimen No. 16 in a match-box with female moths, carefully obtained from the cocoon, and keeping it in the safe over night, the ova have gone through the colour changes of fertilization and upon three occasions eggs have hatched. On another occasion, when six female moths were kept for the experiment, but the actual procedure adopted was not noted, one egg hatched.

This evening I show you several match-boxes containing ova apparently fertilized, in which the female moth was taken straight from the cocoon and treated with specimen No. 16, as previously described. You will notice in some of these experiments numbers of the ova have changed colour; many of them are in different stages of colour changes—orange, pink and slate blue colour.

In one box, one of last year's experiments, three eggs actually hatched and all of them made a fair bid to live, but only one got through to the moth stage. I thought at first it was a female, as its size of body suggested female, but it was a male and mated with a female; eggs were produced which are apparently fertilized. The cocoon spun by this parthenogenic grub was different to the usual golden-yellow or white cocoons, being really of a light green colour. Although only three eggs hatched in this box just referred to, there were numbers of eggs containing larvæ in all stages of development. These parthenogenic results are altogether different from the normally fertilized eggs when normal fertilization has taken place. Ova in all stages of fertilization are not seen and it never occurs that only one or two eggs are hatched.

What attitude the moth takes up with regard to the luminous radium specimen is, of course, uncertain. However, the moth is bombarded with the high velocity β electrons from radium *C* and incidentally the nuclei of the macrogametes are bombarded with these particles of negative electricity and I suppose these nuclei are excited by this treatment and take on development, mitosis and separation out of chromosomes and, as there are no chromosomes from the microgametes (spermatozoids), so the sex of the organism developing must be male, for in this insect, as previously mentioned, the chromosome containing the hereditary factor for sex determines a male. One must also remember that the success of this artificial fertilization depends to a large extent upon the general trend which has taken place in these insects to parthenogenesis, as previously mentioned.

Arrest of Fertilization.

Whilst two moths were mating a cross-fire with No. 9 and No. 19 radium specimens was applied to the female moth for eight hours at a distance of a quarter of an inch. The result of this experiment was that the eggs deposited on the first day went through the colour changes of fertilization, but the eggs deposited on the second day remained yellow. You will notice that the radium dosage applied in the experiments to arrest fertilization is really greater than the lethal dose mentioned in the early part of my paper, but you must remember that the biological effects of radium radiations upon tissues are not immediate and in order to obtain quick results the radium dosage must be increased accordingly.

In Experiment 219 the eggs just deposited by a normally fertilized moth were cross-fired with Specimen No. 18 below and Specimens No. 21 and No. 19 above. This treatment prevented the eggs cross-fired going through the colour changes of fertilization. The eggs near to those eggs cross-fired went through the colour changes of fertilization, but never hatched, as they were destroyed by the latent effects of the diffused radiations. However, the eggs placed at a distance from the treated eggs went through the colour changes of fertilization and next year hatched. This diffusion of radium radiations (so despised by X-ray enthusiasts), together with the high velocity β particles from radium *C* (not present in X-rays) with, of course, γ rays, make radium-therapy the ideal treatment for certain cutaneous affections, particularly early rodent ulcers.

A PIONEER AUSTRALIAN SURGEON AND HIS TIMES.

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Part II.

Twenty years before Richard Harris saw the light, the birth of a nation occurred in the Southern Seas. True, at the beginning, she was a weak, diseased babe, but, in spite of it all, she grew and developed. The development was so marked and so rapid that Darwin, when he visited Australia in 1836, was filled with admiration. "My first feeling," says he, "was to congratulate myself that I was born an Englishman. Here, in a less promising country, scores of years have done many times more than equal number of centuries have effected in South America. It is a magnificent testimony to the power of the British nation." We all know the growth that has taken place since Darwin's visit and now Australia is probably the most vigorous of the daughters of the Queen of Nations. It is only one hundred and thirty-five years, *ab urbe condita* and to-day our largest city contains over a million souls. It was towards this country that Richard Harris turned his eyes in 1839. After qualifying for the medical profession, he travelled extensively in Great Britain and on the continent, visiting the principal hospitals and learning the methods of the chief surgeons of the time. To his native land he returned in 1832, thoroughly equipped for his life's work, and he would have done well had be chosen to remain in Great Britain. "He was, however, a country lad, but of a roving mind," and in 1839 he decided to see what fate and fortune held for him in the New World of the South. It was the spirit of adventure, that mysterious something so thoroughly incorporated in the Britisher, which has made Great Britain the mighty force that she is, that directed his steps to the *ultima Thule*—Australia. He left England in the beginning of August and landed in Australia at the end of November, 1839, after a more or less uneventful voyage. It is true that during a blow there were days of stress and strain, in which the passengers, battened down and confined to the dark and stuffy 'tween decks, had ample leisure to moralize as to the wisdom or otherwise of quitting their native shore, whilst the crew, using every ounce of energy they possessed, were reducing sail and battling with the elements generally. But all this happened on every voyage and it would have been very exceptional if Richard Harris's ship came through without some dirty weather.

Australia was much farther away from England and the European centres of civilization in the earlier years of the nineteenth century than she is to-day. The isolation of Australia, a large, practically uninhabited island continent, was absolute. None but hardy, resolute fellows, the boys of the bulldog breed who have made Old England's name, voluntarily came out to this country. The cow-hearted weakling may have reached these shores, but not of his own free will. Emigration to Australia was a serious business and one not to be undertaken lightly. It meant, in the vast majority of cases, permanent separation from friends, home and everything that makes life worth living and also the life of a pilgrim in a strange and distant land. But to the young, adventurous spirit all this was outweighed by the lure of the New World and the glorious uncertainty of the future, with its probabilities and possibilities. The long, tedious and seemingly interminable sea voyage was an additional deterrent to many. To reach the Land of Promise one had to take passage in one of those cranky, badly found, slow sailing windjammers of a few hundred tons burthren. To be at sea aboard one of these hookers, often for many months out of sight of land, with bad food and rotten water, a crew troublesome, if not openly mutinous, and perhaps an outbreak of typhus or scurvy laying low the majority and killing many, was an experience not readily forgotten. Not the least of the discomforts were the tropics and the doldrums. To be for days motionless in mid-ocean, with nothing but the blue ethereal dome above, the external expanse of waters all round and the sun pouring down his fiercest wrath, blistering the paint and liquefying the pitch, was a most trying ordeal.

Scenes like this, the memory of which lasting throughout life and reminding the traveller of the horrors of the voyage, were not uncommon. No doubt it was the discomforts of sea travelling that made Richard Harris take that practical and kindly interest in "those who go down to the sea in ships and do business in the great waters," of which I shall speak later on. In spite of the severance of home ties, in spite of the terrors and perils of the voyage and in spite of the uncertainty of the future, to their honour be it said, many members of our profession came to this land, made good and had a great deal to do with directing the destinies of Australia. Besides the geographical isolation, there also was that intellectual isolation which must always be endured by those who go to sparsely populated places. The doctor in the early days had, therefore, to work out his own medical salvation; but this was not altogether an unmixed evil, for it made him self-reliant and resourceful.

After quitting the ship Richard Harris applied to the Medical Board for registration as a legally qualified practitioner in New South Wales. His registration certificate is dated December 2, 1839, and the name of Charles Nicholson, M.D., appears as that of one of the signatories.[1]

Sir Charles Nicholson was a big man in Australia and would have been a big man wherever his lot was cast. He was a graduate in medicine of Edinburgh; he came to Australia in 1834, practised his profession and was interested in pastoral pursuits, was a member of the first elective Legislative Council in 1843, was elected three times Speaker, was knighted in 1852, created a baronet in 1859, received the honorary degree of doctor of civil law of the Oxford

[1] The names of the gentlemen who signed Richard Harris's certificate of registration, in addition to Sir Charles Nicholson, were: Kinnear Robertson, Assistant Surgeon (Colonial), Macquarie Street, Liverpool; F. L. Wallace, M.D., Kent and Druitt Streets; and J. V. Thompson, Deputy Inspector of Hospitals, 136, Liverpool Street. The name of Richard Harris is inserted on Folio 28 of the First New South Wales Register.

University in 1857 and the honorary degree of doctor of laws of the University of Cambridge in 1868, was Provost of the Sydney University from 1854 to 1862, obtained a Grant of Arms for the University from the College of Heralds, secured a Royal Charter for the University from Her Majesty Queen Victoria, made repeated donations of a very valuable character to the University—tapestries, pictures and museum of Egyptian, Etruscan, Greek and Roman antiquities.

After registration Richard Harris began his Australian medical career in Parramatta, an old-established town, then only second in importance to Sydney. It was originally called by its first settlers Rose Hill, which, with good taste, was afterwards changed to the more euphonious appellation of Parramatta, the name given by the natives to the river. Parramatta was a town of some importance, owing to the fact that the early Governors had their residence there. Richard Harris's sojourn in this town has a personal interest to me. Here he was a contemporary and friend of a relative of my own, James Dunlop, F.R.S., Astronomer Royal at the Parramatta Observatory.

Several interesting and one tragic event occurred during the time Richard Harris practised in Parramatta. June 13, 1843, was the date of the first election of the representatives of the people to the Legislative Council. This was an epoch-making event and a very big step towards responsible government as we know it to-day. In the early days of Australian settlement, the Governor was monarch of all he surveyed. He worked under the control of the Secretary of State for the Home Department or later the Secretary for War and the Colonies. The people were divided into three classes or casts—the convicts, the emancipists and the free settlers, including the official population. The free people were inclined to look upon themselves as a moral aristocracy and to regard the emancipists with some disdain. Governor Macquarie, who was the last of the autocratic rulers, endeavoured to extend to the emancipists social and official recognition. He insisted that it was unjust that any stigma should attach to those who had endured the ordeal imposed on them and had become free in the eyes of the law. He invited to his table at the Government House some of the emancipists whom he considered fit for recognition and insisted that all emancipists should be eligible for the magistracy or any of the civil posts for which they were competent. This was the first step in the social evolution of Australia.

The second was made in 1823, when the New South Wales *Judicature Act* set up a Legislative Council of not more than seven nor fewer than five members. These were all the Crown's nominees and had no power to control or limit the authority of the Governor. In 1828 the Act was amended by enlarging the Legislative Council to a maximum of fifteen members, who were still to be nominated by the Crown. This new Council had the power to reject by a majority any proposal made by the Governor. In 1842 the Legislative Council was reconstructed, when its membership was fixed at thirty-six, of whom twenty-four were to be elected and the remaining twelve were nominated by the Governor. It was this election that took place when Dr. Harris was in Parramatta. So far had the emancipists gained recognition that in this first election Dr. Bland, an ex-naval surgeon who had been transported for "killing his man" in a duel, was elected with Wentworth top of the poll for Sydney. New South Wales was at that time the whole of the eastern portion of the continent.

On July 16, 1847, Her Majesty's ship *Rattlesnake* arrived in Sydney and this event, pregnant with potentialities, might have had a great deal to do with the history of Australian science in general and that of the University of Sydney in particular. On board this ship was a young assistant surgeon named Thomas Huxley, unknown then, but afterwards one of the best-known scientists of his day. In 1853 the establishment of a chair in natural history was spoken of at the University and there is reason to believe that for the chair Huxley would have been a candidate. He was in frequent communication with friends in Sydney at that time and he would have gladly accepted a suitable appointment in Sydney. I believe when he married, an Australian lady became the wife of the famous professor. It is interesting to note that Dr. John Harris, of Newcastle, when a medical student at the University of Aberdeen, met Huxley several times at dinner in the house of Professor Struthers and was greatly impressed by the profound knowledge of Australia that Huxley commanded.

In 1848 the *Rattlesnake* convoyed *The Tam o' Shanter,* which carried Edmund Kennedy and his party, to Cape York Peninsula. Kennedy was the leader of an expedition to explore the coast country from Rockingham Bay to Cape York. Dr. Logan Jack ("Transactions of the Royal Australian Historical Society") says: "The debarkation at Tam o' Shanter Point took place on May 28, 1848. Among the officers who landed was a young naturalist, Thomas Huxley, who made a spirited drawing of Kennedy's start." Huxley was well known for his artistic sense and his dexterity with the brush and pencil. Her Majesty's ship *Rattlesnake* was rendered famous by the realistic painting by Sir Oswald Brierly on one of the walls of the dining room at that "dear, fair, quaint old home," "The Rangers," at Mosman's Bay, Sydney. *The Rattlesnake* is depicted in a squall off Timor. The painting is so vivid that more than one old mariner has had his emotions stirred while viewing it. The story is told of how Commander Richards, of Her Majesty's ship *Acheron,* while contemplating the grandeur of the pictorial storm, suddenly exclaimed: "Why the devil didn't he let go his halyards" (Edward A. Archer, "Transactions of the Royal Australian Historical Society"). I believe "The Rangers" has been demolished in recent years.

The tragic event that occurred at Parramatta in Richard Harris's time was the death by accident of Lady Mary Fitzroy, the wife of the then Governor. On December 7, 1847, Sir Charles and Lady Mary Fitzroy, together with Lieutenant Chesters Masters, were about to drive to Sydney to attend a wedding. For some reason the horses bolted on the way down the hill and at a bend in the road the coach came

in violent contact with an oak tree and was smashed to pieces. Lady Mary Fitzroy and Lieutenant Masters were killed. Lady Fitzroy was, it is said, well versed in domestic economy. Her good sense is illustrated by the following anecdote. Soon after her arrival a rich ironmonger called early one morning at the Government House when Lady Mary was busy about her domestic duties. Meeting her at the entrance hall, in morning costume, he mistook her for the housekeeper and, slipping a five pound note into her hand, expressed a hope that she would secure him the patronage of the establishment. The sum was accepted and sent to one of the charitable institutions.

Richard Harris remained in Parramatta till the end of 1849. During his stay in the old town he did well and his influence for good was felt in many directions. Had he chosen to remain there permanently there is no doubt but that he would have become one of the prominent citizens of the district; but he heard the "call of the wild" and Mudgee was the next scene of his activities. Mudgee in 1849 was a small village situated in the County of Wellington, on the Cudgegong River, about one hundred and fifty miles north-west of Sydney. It contained one hundred and thirty-one inhabitants and nineteen houses. Richard Harris took up land in this district and engaged in pastoral pursuits, besides practising his profession in the village. Can we, with the convenience of railways, motor-cars and even flying-machines, adequately realize what an undertaking a journey from Sydney to Mudgee was seventy years ago? Richard Harris, having hired two horses, a tilted cart and a driver, set out one morning in the middle of December, 1849, for his future home out west. He travelled by day and camped near the cart by night and at the end of six days reached Mudgee. Young, strong and eager for adventure, he fairly revelled in the gipsy life on the road. The phantasmagoria of that wild dreamland termed the bush fascinated him and made him comprehend why free Esau loved his heritage of desert sand better than all the bountiful richness of Egypt.

In Mudgee all the work was done on horseback and his life in this part of New South Wales was one long, strenuous effort. He was in journeyings oft and in perils not a few. Isolated many miles from the nearest help, Richard Harris had often to do single-handed operations and other surgical procedures which would now be considered necessary for a team to grapple with. His life at this time reminds us of Ian Maclaren's doctor of the old school: "One is to answer," says Maclaren, "a question that has been often fairly asked. Was there ever any doctor so self-forgetful and so utterly Christian as William MacLure? To which I am proud to reply on my conscience: Not one man, but many in Scotland and in the South Country. I will dare prophecy also across the seas. It has been one man's good fortune to know four country doctors, not one of whom was without his faults—Weelum was not perfect—but who, each one, might have sat for my hero. Three are now resting from their labours and the fourth, if he should ever read these lines, would never identify himself." Richard Harris, I am sure, would never have recognized his portrait here and yet the work he did at this stage was very similar to that performed by Weelum MacLure. He continued to work in the Mudgee district till 1861, when he began the third and last period of his Australian life.

In 1861 Richard Harris was appointed Government Inspector of Coal Fields in the Newcastle District. Newcastle sixty years ago was but a small town, depending almost entirely for its existence on the winning and exporting of coal. This appointment was not altogether congenial, neither was it as remunerative as his own profession, so after a brief period of "outside" work he resumed practice, first in Market Square, then in Hunter Street and finally, in 1870, in a house in Watt Street erected by himself, where he continued to reside till he breathed his last.

Ovariotomy in 1868.

Let me not be misunderstood, Richard Harris was not a genius. A genius, as we all know, is an abnormality who comes only once in a very long while, but when he does appear he wields a tremendous influence for good or evil. The wind bloweth where it listeth and thou hearest the sound thereof, but canst not tell whence it cometh and whither it goeth; so is the coming and going of a genius. He does not perform the regular work of the world, but he is as necessary in the economy of things as the crank and eccentric are for the proper working of an engine. Neither do I claim that Richard Harris was the brightest star in the New South Wales medical firmament. I am sure he would not have laid claim to that distinction himself. He was, however, one of those quiet, reliable, conscientious, resourceful men who are the backbone of any movement.

I cannot even say that Richard Harris was the first to perform ovariotomy or improve the technique of the operation. Ovariotomy had already been performed by British, continental and American surgeons with more or less success. I think I am right, however, in saying that when Richard Harris performed ovariotomy in 1868, the operation was unique in the Newcastle district and was one of the very first deliberate attempts at big abdominal surgery in Australia. "Ovariotomy," says Thomas Bryant in 1872, "in a general way is the only radical cure for ovarian cysts. At present the operation is an accepted one by the profession. It is as recognized and as justified as any other grave operation. British surgeons may probably claim the credit of having established this fact."

The operation was still in a more or less experimental stage and there were many problems to be solved. There were discussions as to which cases required operation, when the operation should be done, the position of the patient on the table, whether she should be lying on her back, reclining, sitting up or assume the right or left lateral position. Sometimes a combination of these positions was considered the best. The length and position of the incision was a question about which there was some argument. But the two chief difficulties to be cleared up were the treatment of the pedicle and the management of the adhesions. We must remem-

ber that these were the pre-antiseptic and aseptic days, when it was considered highly dangerous, if not fatal, to explore the abdomen with the hand or sponge out any fluid that may have escaped into the peritoneal cavity.

Let us consider for a moment the outlook of an unfortunate woman with an ovarian cyst before ovariotomy became a recognized operation; truly her position was deplorable. To be sure, the cyst was at times tapped and injected with iodine or some similar fluid with occasional success, but success could not be guaranteed in any case and certainly not when a multilocular cystic tumour was present. Without operation there was only one ending; the patient had quietly to submit to her fate, bear the inconvenience of an ovarian tumour, endure the living death of misery and pain and incapacity due to its more mature development and finally die worn out and exhausted. The whole cycle would, as a rule, be completed in less than three years. It is no wonder, then, that ovariotomy was the first abdominal operation to be practised and perfected and it was the one that paved the way for modern abdominal surgery. Abdominal surgery was not extensively practised till long after the introduction of antiseptics. Maylard, of Glasgow, tells us that in 1880 when he was Senior House Surgeon at Guy's Hospital, there were only twenty-three abdominal operations performed at that institution throughout the whole of that year. These twenty-three were made up as follows: two laparotomies for intestinal obstruction, both fatal; three gastrostomies, all successful, and eighteen ovariotomies, of which six were fatal. Other records show a similar paucity of abdominal cases.

Dr. Richard Harris's Case.

Richard Harris was by early training and more mature experience well qualified to undertake any surgical procedure that might present itself. He had kept himself well abreast of the times and had acquired all that there was to be known about the treatment of ovarian tumours. When, therefore, the following case came under his notice, he had a plan of campaign well developed and was able to bring to a successful issue the treatment of a case which, sixty years ago, was regarded as one of the gravest with which a surgeon had to do. Miss M. was a domestic, aged thirty years, who, besides being cumbered about much serving, had the additional burden of a big abdominal tumour to carry about constantly. She had suffered many months in silence and tried to conceal her condition from her mistress and friends, knowing that they would wrongly diagnose her disability. However, as time passed, her condition became more and more unbearable, till finally, what with the increasing weight of the tumour, breathlessness on exertion, bodily emaciation and pain, she had to cease work and consult a doctor. It was over twelve months from the beginning of her symptoms till the time when she sought medical advice. Having heard Dr. Harris's opinion, that she was suffering from a large cystic tumour of the ovary, she discussed with him the various methods by which the condition could be treated and, as he could not guarantee a cure by the less drastic means, she implored him to operate and give her that chance, as she preferred death itself to her present miserable existence. The operation was performed in the morning on June, 14 1868.

Can we visualize the scene? In a small back room in a house in Brown Street, Newcastle, the drama was enacted. The actors were Richard Harris, the surgeon, who did the operation single-handed; John Harris, his nephew and apprentice, who administered the anæsthetic; Miss M., the patient, who had undergone some preliminary treatment, and a household Martha from next door, present probably to see that the young woman got fair play. I can say with all confidence that in this case Moynihan's surgical ritual was not carried out in its entirety; but still Richard Harris was a clean man and, while he recognized that cleanliness is next to godliness, he also recognized the fact that it had, in addition, something to do with the healing of wounds. The patient was anæsthetized in a reclining position on the dining room table and stood the shock of the operation and chloroform exceedingly well. The steps of the operation are soon described. He made a five-inch incision in the middle line of the abdomen and came immediately on to the tumour, which he steadied and kept close to the abdominal parietes with a silk thread passed through the wall of the cyst, while he plunged a large trocar and cannula into its cavity. As it happened, the tumour was a polycystic-pseudo-mucinous adenoma, so he had to use the trocar and cannula many times before the bulk of the tumour was sufficiently reduced to enable him to deliver it through the abdominal opening. Not much of the cystic contents could have escaped into the peritoneal cavity and what did escape must have been sterile, as no peritonitis followed. Having delivered the tumour, he closed the abdominal opening with silk sutures and sewed the skin to the pedicle with the same material, clamped the pedicle and cut away the tumour. The clamp was left on for five days and the convalescence was practically uninterrupted.

This, I am sure, was the most spectacular piece of surgery that ever fell to the lot of Richard Harris and fortunately it was a success.

Conclusion.

Richard Harris spent the last twenty-six years of his life in Newcastle and it was during this period that his best work was done. He had the confidence of the people, who regarded him as a safe man and one to whom they could go with all their troubles; but his work, heavy and constant, which would have taxed the resources of many a younger man, began in his later years to demonstrate the fact that human endurance is limited.

In 1887 his friends noticed with some concern that his step was beginning to lose its elasticity and his wonderful energy, which in the earlier years seemed inexhaustible, had begun to wane. Naturally optimistic and determined, he refused to admit that anything of a serious nature was to be anticipated and tried to persuade his friends that his loss of vigour was but temporary. But his race was run and the goal was in sight and, although he worked on for a while, in spite of increasing weakness, he

was at length forced to rest from his labours and await the end. He passed from sight on November 3, 1887, aged seventy-nine years. His grave is situated in a quiet spot in the Sandgate Cemetery, close to the Newcastle-Maitland highway. It was along this road that many of his journeys were made on horseback in the gone by years.

The times change and we must change with them if we are to keep in harmony with our environment and so to-day along this same road the twentieth century doctor whirls by the Place of the Dead in a swiftly travelling motor-car, little recking that here in this place hard by the road there sleeps one who in times past was a big factor in the medical life of Newcastle. The present generation has forgotten Richard Harris. *Sic transit gloria mundi.*

The lives and doings of men like Richard Harris are, I think, worthy of record. The great men of the profession have their memories perpetuated in many ways, but the obscure, those silent heroes of the distant bush places, although they, single-handed and often against great odds, many times perform deeds which should have a permanent place in the history of medicine, die and sink at once into oblivion. Even Gray, in his "Immortal Elegy," forgot to remind us of the village doctor. It is with the object of preserving the memory of one of these less known men that I have written here of Richard Harris.

Physically Richard Harris was above medium height, broad shouldered and thick set. His arms were long and powerful and his whole appearance gave the onlooker the impression that he was a man with great reserve force. But he wore a beard; a bearded surgeon to-day would be an anachronism. It has been mentioned that his father was a soldier. May I say that his father was one of seven brothers, all of whom served with distinction as officers in the British Army, and their mother, who lived to her hundred and fourth year, on account of her patriotism, received an Imperial pension.

Richard Harris was a successful man (not in the fact that he accumulated money, although I believe he had plenty) in the sense that he became a thoroughly reliable, well informed medical practitioner, willing to spend and be spent in the cause of humanity. Dr. Harris's benevolence was proverbial. He was a widower with no family of his own, but he educated and launched successfully into the world no fewer than thirty nephews, nieces and other relatives.

He was Health Officer to the Port of Newcastle, Government Medical Officer, Visiting Surgeon to the General Hospital and Hospital for the Insane and Surgeon to the Permanent Artillery Force. Richard Harris was a good friend to and protector of that peculiar specimen of humanity, Jack ashore. The deep sea sailor was merely a grown-up child, as suspicious as he was simple. He resented with warmth the administrations of anyone whom he considered a "holy Joe," but was easily deceived, robbed, drugged and "shanghaied" by those infernal harpies who thronged every big seaport, the crimp and boarding-house runner. With tact Dr. Harris gained the confidence of the seafaring man and established the Bethel Mission at Carrington. At his own expense he built the mission reading room and chapel for seamen and took a keen and personal interest in the management of the institution. He was also one of the governors of the Newcastle Sailors' Home.

Without taking a very great part in public matters, the old doctor was always ready to assist in any good work and was a ready contributor to public charities and to any private undertaking for the public good. He was first President of the Newcastle Young Men's Christian Association and a firm supporter of the British and Foreign Bible Society.

Whilst cherishing the glories of the past, Richard Harris was always ready to take advantage of any innovation which appeared to him as worthy of adoption. The stethoscope, clinical thermometer, anæsthetics, antiseptics and other "curiosities" were all introduced to Australia after his arrival and the virtues of each were readily appreciated by him. He was fortunate in having lived at such an interesting period, for he saw the evolution of modern medicine and the evolution of Australia. By his death another link with the past was broken.

The old-time doctor is gone and his ultra-modern brother reigns in his stead. One cannot help regretting the passing of the former, as one regrets the passing of the clipper ship; they were both picturesque and did a tremendous amount of good work in their day, but—

> The old order changeth, yielding place to the new,
> And God fulfils Himself in many ways,
> Lest one good custom should corrupt the world.

Chronology.

The following are just a few of the interesting events that happened during the medical life of Richard Harris (1830 to 1887): 1831—Guthrie, Liebig and Soubeiran discovered chloroform; 1832—the passing of the *Anatomy Act;* 1834—Dumas obtained and named pure chloroform; 1842—Long operated with ether anæsthesia; 1843—Royal College of Surgeons of England; 1845 (?)—stethoscope introduced to Australia; 1847—Simpson introduced chloroform anæsthesia in obstetrics; 1850—University of Sydney founded; 1851—Helmholtz invented the ophthalmoscope; 1852—Pravaz introduced the hypodermic syringe; 1852—the first administration of chloroform for surgical purposes in Sydney by Dr. H. G. Alleyne; 1852—University of Melbourne founded; 1855—Manuel Garcia introduced the laryngoscope; 1861—Pasteur discovered anaerobic bacteria; 1867—Lister introduced antiseptic surgery; 1874—University of Adelaide founded; 1880—Pasteur discovered the streptococcus and staphylococcus; 1882—Koch discovered the tubercle bacillus; 1883—Edwin Klebs discovered the diphtheria bacillus; 1883—Sir T. P. Anderson Stuart arrived in Sydney and established the Medical School; 1885—New South Wales had her baptism of fire in the Soudan Campaign; 1888—had Richard Harris lived a few months longer he would have seen the first batch of medical graduates of the Sydney University Medical School.

Acknowledgements.

I wish to offer my best thanks to Dr. John Harris for the life story of his late uncle, Richard Harris;

also to Mr. Campbell, of Newcastle, for supplying information and consulting old files of the *Newcastle Morning Herald* and Drs. G. H. Abbott and R. H. Todd for information. I have consulted and quoted the following works: "A Short History of Australia," by Ernest Scott; "Memorials of the Life of James Syme," by R. Paterson, M.D.; "Memoirs and Letters of Sir James Paget," by Stephen Paget; "The Book of Edinburgh Anecdotæ," by Francis Watt; "The Trial of Burke and Hare," by William Roughead; "The Transactions of the Royal Australian Historical Society"; "An Introduction to the History of Medicine," by F. H. Garrison; "Early History of Surgery in Great Britain," by G. Parker; "Short Historical Account of the University of Sydney," by H. E. Barff, M.A.; "The History of the University of Glasgow," by J. Coutts, M.A.; "Memorials of the Faculty of Physicians and Surgeons of Glasgow," by A. Duncan, B.A.; Bryant's "Surgery" (1873); "The Life of Charles Darwin," by Francis Darwin; "Voyage of a Naturalist," by Charles Darwin, M.A., F.R.S.; "A Doctor of the Old School," by Ian Maclaren; "Remarkable Events in Australia" (published 1852); "Practice and Problem of Abdominal Surgery," by Maylard; Wells's *Gazetteer*; "Life of Sir T. P. Anderson Stuart," by William Epps; "History of the Sydney Hospital," by J. Frederick Watson, M.B., Ch.M.; "New System of Gynæcology," by Eden and Lockyer; class certificates, diplomas *et cetera* of the late Richard Harris; Introduction to "A. L. Gordon's Poems," by Marcus Clark.

Reports of Cases.

BILATERAL DETACHMENT OF THE RETINA IN NEPHRITIS OF PREGNANCY; RE-ATTACHMENT OF RETINA.

By Mark Gardner, M.C., M.D.,
Ophthalmic Surgeon, Hospital for Sick Children, Melbourne; Consulting Ophthalmic Surgeon to Women's and Austin Hospitals, Melbourne.

Dr. Eugene M. Blake has reported a very similar case in the November number of *The Archives of Ophthalmology* and has given a full bibliography. I would refer readers to that excellent article and will not quote from it.

M.M., *ætatis* thirty-three years, was admitted to the Women's Hospital on December 19, 1922. There had been three normal pregnancies without medical assistance. There was no history of previous eye trouble. She had had headache off and on for five years. There was no history of scarlet fever. Her family history was good. A month before admission she had noticed swelling of both legs and some shortness of breath. Abdominal pain had set in a week before. On December 17 her sight became dim. She did not become unconscious at any time, nor had she any fits.

On admission she was found to be in the sixth month of pregnancy. There was œdema of the lungs, conjunctiva and lids. Her blood pressure varied between 190 and 220 millimetres of mercury. Her urine was scanty and contained a considerable amount of albumin and many casts.

On examination of her eyes I found almost complete detachment of both retinæ. The detachments could be seen by oblique illumination. She could detect hand movements with each eye, but could not count fingers. Projection of light was imperfect. Both optic discs were very œdematous, as was also the small amount of undetached retina in each eye around the optic discs. The œdema extended to the maculæ. There were no hæmorrhages. A small amount of "cotton wool" exudate was seen near the vessels.

Dr. Robert Fowler, under whose care she was, performed Cæsarean section under spinal anæsthesia on the day after admission. He had intended to perform Porro's operation, but the patient collapsed on the table and it was not thought advisable to continue. Convalescence was uneventful.

Fundus examination a fortnight after operation showed a shallow detachment above in the right eye; no further exudate or hæmorrhage was seen. In the left eye there was some fresh "cotton wool" exudate and some recent hæmorrhage. No detachment was seen. The papillœdema was much less in each eye.

The patient was discharged on January 17, 1923.

The condition at present is as follows: The vision of the right eye is $^6/_6$, which was brought to $^6/_6$ with small myopic correction. That of the left eye is $^6/_6$ unaided. The fields of vision are quite full in each eye. There are no scotomata. The papillœdema has cleared. The remains of the exudates and hæmorrhages mentioned above are to be seen. There is no fresh disturbance. The detached retina has therefore been re-attached completely.

Reviews.

RECENT ADVANCES IN BIO-CHEMISTRY.

The changes which take place in substances, such as proteins, fats, carbo-hydrates and their derivatives, undergoing active metabolism in the animal body, are of great interest and significance to biological science. At the same time, such investigations present extraordinary difficulties, since they include not only a search into the beginning and end products, usually a comparatively simple problem, but also into the intermediate steps through which the substances have passed while they are still in the body.

Dr. H. D. Dakin has published a monograph in which he deals with those changes which involve oxidation and reduction and which are known to occur in the animal body.[1] During the eleven years which have passed since the last edition, no particularly new methods of study have been evolved, but existing methods have been improved and much new information gained. Considerable additions have, therefore, been made to the facts contained in the book.

A critical discussion is given of Wieland's recent theory of oxidation, according to which oxidations and reductions are regarded as reversible reactions in which hydrogen is either removed or added. Bio-chemical oxidation, therefore, does not involve the activation of oxygen, as was assumed in the older peroxide theories, but rather the activation of hydrogen and its subsequent removal by means of catalysts. Dr. Dakin shows that there is much to be said for this theory and believes that, taken in conjunction with the peroxide theory, it may help to throw light on the mechanisms of many bio-chemical reactions.

Great interest attaches to the recent discovery by Gowland Hopkins of the remarkable substance, glutathione, which appears to play an important part in the oxidations and reductions occurring in the living cell. This substance is of a dipeptide nature and is composed of cystine or cysteine united to glutamic acid. The reduced form, corresponding to the cysteine compound, can react with oxygen, hydrogen is removed and the cystine or oxidized compound formed by the function of two molecules. This oxidized form can then take up hydrogen, again forming the reduced compound.

The pair of substances can thus take up both oxygen and hydrogen and possesses precisely the properties of a co-enzyme to an oxidase system. An excellent account of

[1] "Monographs on Biochemistry: Oxidations and Reductions in the Animal Body," by H. D. Dakin, D.Sc., F.I.C., F.R.S.; Second Edition; 1922. London: Longmans, Green & Company; Royal 8vo. pp. ix. + 176. Price: 6s. net.

this substance is given and its possibilities as a co-enzyme discussed.

The newer investigations into the structure of the sugars have revealed that glucose exists in a variety of interconvertible, isomeric forms which possess distinct differences in chemical properties. The chapter on the carbohydrates has been entirely rewritten, so as to include the results of these researches.

The rest of the book follows the same lines as the earlier edition, while an excellent bibliography is appended.

The monograph calls for little criticism of an adverse nature; the subject is presented throughout in a simple manner and cannot fail to stimulate further research into the many unsolved problems which are discussed. It thus fufils one of the most important functions of these monographs on bio-chemistry.

INDUSTRIAL HYGIENE.

"Industrial Hygiene and Medicine," by Drs. Hope, Hanna and Stallybrass,[1] is not only a very timely publication, but a most valuable one to both medical practitioner and student. The book is very complete, covering vital statistics, records and record keeping, general hygiene, dust and specific hazards, industrial medical service, accidents and accident prevention. Each chapter has appended to it a very complete bibliography of English, French, German and American publications which give a summary of the literature up to January, 1923.

In Chapter X., on industrial welfare, the authors deal with the practical application in factories and shops of the subjects covered in the previous chapters. Surely the time has come to divorce industrial hygiene from welfare, if this term be used in the narrow sense in which it is applied in industry. It does not seem probable that the employer can be induced to accept the importance and necessity for industrial hygiene as long as it is tacked on to welfare, which too frequently implies in his mind giving the employees something for nothing to which they are not entitled. The authors state on page 614: "A well-equipped and well-organized ambulance and medical service is a valuable adjunct of welfare work affecting both the employer and the worker." While we have no desire to quarrel with welfare work, we would point out that, until industrial hygiene is recognized as a thing quite apart and on an entirely different plane, it can never come into its own. Physical examinations, the supervision of the adolescent worker, the control and eliminations of specific hazards, the provision of adequate ventilation and illumination are no more part of welfare work than the erection of suitable buildings, the purchase and repair of suitable machinery or the supply of steam and electric power. On page 642 of the same chapter, dealing with the duties of the welfare supervisor, the authors include supervision of ambulance rest room and first aid and state that, while the welfare supervisor "should work in close touch with the factory doctor and nurse," she should be responsible for help in the selection of nurses, should see that their work is carried out promptly and should superintend the keeping of all records of accident and illness in the ambulance room. These should be responsibilities of the medical officer and of the nurses and the obstrusion of a third person into the situation is unnecessary and undesirable.

These are but minor flaws in an admirable book. The time has arrived when the status of industrial medicine should be clearly defined and its dignity and economic worth appreciated. This book is bound to have a wide sphere of usefulness, but there would be little to attract the recent graduate in medicine to industrial medical service if he is to consider himself an adjunct to welfare schemes.

[1] "Industrial Hygiene and Medicine," by E. W. Hope, O.B.E., M.D., D.Sc., in collaboration with W. Hanna, M.A., M.D., D.P.H., and C. O. Stallybrass, M.D., D.P.H.; 1923. London: Baillière, Tindall & Cox; Demy 8vo., pp. viii. + 766, with 122 plates and figures in the text. Price: 25s. net.

SURGICAL PRACTICE.

The public press, both in England and Australia, with a singular lack of discrimination and with an insatiable hunger for the sensational, have given great prominence to certain passages of Dr. Harold Burrows' admirable book, "Mistakes and Accidents of Surgery."[1] Surgeons, being human, must occasionally make mistakes. Errors of judgement are bound to occur in view of the difficulty of doing the right thing in an unusual emergency. It is stupid and irrational to attack an author and a great profession by quoting instances of rare mistakes from a volume that has for its object the reduction of these errors in practice. In his book Dr. Burrows not only enumerates many surgical disasters, but indicates in many instances the means by which they may be avoided. He considers in a general manner the sources of surgical errors. The book is much more than a mere catalogue of mistakes.

He rightly emphasizes the importance of team work and of careful clinical examination.

In exposing the thyreoid gland he advocates division of the deep fascia and thinned out infra-hyoid muscles in their lower third. Many surgeons prefer the method used in the Mayo Clinic, in which the infra-hyoid muscles are divided in their upper third and above the point of entrance of their nerve supply.

The chapters on appendicitis and intestinal obstruction are good; they teach the importance of early diagnosis and early surgical treatment. The author would seem to hold the opinion that the use of the "gridiron" incision is a mistake. Many surgeons will not agree with this.

In the section dealing with amputations he includes the majority of the lessons learned after many mistakes during the war. Thus, when the bones of the leg can be divided at the usual level for a Syme's amputation, but the heel is damaged, a useful end-bearing stump may be obtained by using flaps from the lateral or dorsal aspects of the foot.

In discussing acetonuria, he remarks that the phrase "odour of sanctity" may have arisen from the sweet odour of the breath observed in cases of acetonuria brought about by starvation or prolonged fasting.

The author has set out in a concise manner many surgical mistakes and the book should prove a useful one to any surgeon who wishes to avoid them.

PUERPERAL SEPSIS.

A little book, "Puerperal Sepsis and its Prophylaxis," by Dr. Eustace Thorp,[2] deals in a brief manner with a subject of great importance, a subject full of difficulties and one in which more light is badly needed. The book, however, is disappointing and contains little that is not to be found in any text-book on midwifery.

The author's theory that epidemics of puerperal sepsis generally begin in a mild form and acquire virulence by passage through the human body is at first arresting. This would imply that the virus is a specific one in such cases, but the subsequent pages do not tend to confirm the idea.

Under ætiology he states that infection may be caused by any of the organisms enumerated as having their normal habitat in the vagina or its neighbourhood—auto-infection—or the infection may be conveyed from outside—conveyed infection.

The chapter on prophylaxis is a good one. Those on symptomatology, pathology, diagnosis, prognosis, treatment and complications follow well-worn paths and will prove tedious to anyone familiar with a text-book.

On the whole, this book cannot be said to satisfy the need which undoubtedly exists for guidance in the matter of puerperal sepsis.

[1] "Mistakes and Accidents of Surgery," by Harold Burrows, C.B.E., M.B., B.S. (Lond.), F.R.C.S.; 1923. London: Baillière, Tindall & Cox; Demy 8vo., pp. viii. + 470. Price: 10s. 6d. net.

[2] "Puerperal Sepsis and its Prophylaxis," by Eustace Thorp, O.B.E., L.R.C.S., L.R.C.P., L.F.P.S.G., D.P.H.; 1922. Bristol: John Wright & Sons, Limited; Crown 8vo., pp. 48, with six charts. Price: 2s. 6d. net.

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Mental Defect and Delinquency.

Each year the reports of the State Children's Boards and the records of the Children's Courts reveal a picture that is at once discreditable to the Commonwealth, deplorable and irresponsible. Scores, hundreds of children of both sexes are brought into the compass of the law because of some social defect. Either the environment of these children is of a kind that their future welfare, happiness and utility are endangered or they have proved themselves to be out of tune with their environment. At first sight it is thought that the problem is one of wrongdoing on the part of the parents, guardians or children. The authority is inclined to prescribe rigid schooling and temporary seclusion. A feeble attempt is made to reprove the parents or guardians for their neglect. As a rule the real nature of the problem is overlooked and as a result the evil process is permitted to become perpetuated.

It is not only in the industrial homes and schools for delinquents that the underlying process is reflected. In the prisons and hospitals for the insane a further phase is discovered. Again, the streets at night-time, the brothels, the gambling hells, the drinking dens are scenes intimately connected with feeble-mindedness and mental deficiency, with the psychopathic individual whose self-control and adjustment in the social world is lacking. The fault lies in the failure to recognize the pathology of disturbances of normal conduct, of want of development of those cells in the brain that govern intellectual thought. The education authority and the judiciary appear to be incapable of realizing that conduct is a property of a well-balanced mind and that there are forms of mental defect which provide the individual with an incapability of resisting impulses and of controlling passions. No one has any difficulty in recognizing the condition of the idiot, the imbecile and the low grade moron. The difficulty first arises when the intellectual qualities of the individual are but little altered. Moral defect may co-exist with highly developed intelligence.

Drs. Walter L. Treadway and L. O. Weldon and Miss Alice M. Hill have recently completed an exhaustive study of the physical, mental and social conditions of prostitutes detained or quarantined in Kansas and Kentucky. Their experience does not differ greatly from that of other competent observers in other parts of the world. Girls and women committed to the State Industrial Farm and to similar institutes either on account of sexual offences or because of the existence of a venereal infection were found to provide the best key to the problem of the mentally defective and psychopathic child imaginable. About three-quarters of these prostitutes, on being tested for age levels of intelligence, proved to correspond to normal children under twelve years of age. No less than 55.3% of the group were either feeble-minded, epileptic, psychopathically inferior or suffering from a definite psychosis. Dr. Treadway described them as possessing an egotistical personality, a seclusive or fatuous personality or an obstrusive personality. It was found that of sixty-six girls concerning whom reliable information was available, fifty-six had started their sexual delinquencies before the age of consent, namely, eighteen years; one child was only six years of age when the first sexual act was performed, while fifteen others were under the age of thirteen. It is unnecessary to recite in this place the heart-breaking, nauseating details of these tragedies. Unfortunately they are common in every country. It should be mentioned that in the majority of the girls and women the sexual impulse was feeble. Their prostitution was merely an easy road; they were incapable of commanding a good living wage in decent walks of life and their mental make-up contained no effective obstacle to the adoption of this mode of procuring money, food, lodging and finery. Their teeth, like their minds, were neglected and defective. The question is raised whether the faulty environment of immoral, squalid and unstable homes contributed greatly to this state of inferiority and loss of mental vigour or whether the inherited tendency was the

more powerful. Every psychologist with knowledge of psychiatry and physiology realizes that the taint passing from parents to progeny counts for more than evil associations.

Prostitution in both sexes, criminal tendencies of all sorts and inability to adapt himself or herself to the social conditions of any community are more frequently signs of mental defect or faulty cerebral development than of vicious qualities. The epileptic who steals or commits violence, should not be regarded as a criminal; his offences are signs of his abnormal brain function. Sexual crimes and perversions should not be punished; they should be prevented and the only way to prevent them is to endeavour to ascertain the inherent mental defect before the tragedy becomes apparent. The heredity of this form of defect is left untouched if the individual is committed to prison for a time after the commission of a sexual offence and is then allowed to propagate his or her kind.

It is possible for well-trained medical psychologists and psychiatrists to detect masked forms of mental deficiency likely to lead to moral delinquencies while the child is young. A thorough investigation of all school children from this point of view should be undertaken and those whose conduct is found to be abnormal and whose mental development is not up to standard, should be segregated and placed under continuous supervision. Time will reveal to competent observers whether the defect is a permanent one or not. If it is permanent, steps must be taken to provide a permanent control. The trained medical psychologist is not inclined to forget the association of moral deficiency with a good standard of intelligence. It will, however, be found that a morally defective child with ability to learn may escape detection during school life. For these individuals machinery must be provided, so that the law does not dispense the wrong remedy for an offence that may be the first of a long series. Above all, permanent segregation must be enforced as soon as the nature of a moral defect is detected. There is much work to be done in elucidating the types and qualities of candidates for prostitution and gaols, but sufficient information is available for the authorities to make a start.

Current Comment.

THE CONTROL OF LEPROSY.

Since the discovery by Hansen of the *Bacillus lepræ* in 1871 a considerable change has come over the attitude of the medical profession towards the isolation of leprous patients and the general prophylaxis of the disease. This attitude towards leprosy has passed through several curious phases. History shows that it was recognized many hundreds of years before the birth of Christ. In those times it was chiefly confined to the eastern countries. Its advent to western Europe probably did not take place till the second century. Since that time it has spread to all countries. In the early days it was commonly believed that the disease could be passed on from one person to another. Thus, in the old Mosaic law specific instructions are given in regard to the leper. He was compelled to distinguish himself by "rending his clothes," putting a covering upon his upper lip and crying "Unclean!" He was regarded as "defiled." It was directed that he should live alone and that his habitation should be without the camp. Specific instructions were also given for the cleansing of a house in which the plague of leprosy had been found.

The communicability of leprosy was generally accepted until some doubts were thrown on this view by the suggestion that the underlying basis was heredity. At the latter end of the first half of the nineteenth century a reversal of opinion took place and the view in regard to heredity was accepted by many. There were those, however, who could not be converted to the altered view and their position was vindicated in 1871, when Hansen described the acid-fast bacillus that is now recognized as the cause of leprosy. The discovery of the causal organism reverted general opinion to the infectivity of the disease. There were other considerations which had done much to raise doubts in the minds of many as to the correctness of the heredity hypothesis. Chief among these considerations was the extensive and rapid spread of leprosy in the Pacific Islands. This occurred in such a manner as to exclude heredity as the only causative factor.

The view which is accepted in regard to the causation, has had much to do with efforts to stamp out the disease. With the doctrine of heredity looming largely in the accepted views of the ætiology there was a tendency to relax measures of segregation. That no relaxation should be tolerated is now an accepted fact. Evidence in support of this point of view has recently been offered by Sir Leonard Rogers in a paper which he read before the Royal Society of Medicine. He tabulated the particulars which he had obtained in regard to the source of infection of seven hundred patients suffering from the disease. The figures which he gave are illuminating. He found that no less than 27.4% of these seven hundred patients gave a history of sleeping in the same bed as an infected person, while 58% of of the patients had lived in the same house as infected persons. In dealing with the segregation of

lepers, several difficulties are encountered. In the first place, the unsatisfactory methods of treatment in the past and the slowness of cure have led to the belief that to be afflicted with leprosy means life-long isolation from all contact with the world at large. The result has been that patients known to harbour the disease have been wilfully hidden. Rogers has stated that only one patient in five was discovered and isolated in Norway within the first three years of the appearance of symptoms. With the newer methods of treatment by means of the injection of the esters of chaulmoogra oil, more satisfactory results have been obtained and patients have frequently been discharged from hospitals as cured. The second difficulty is that of diagnosis in the early stages of the disease. With well-established changes in the skin, with prominent nodules of the tubercular form, with thickened nerves and wasting of the muscles of the hands and feet and with the anæsthetic areas of the anæsthetic form of the disease, diagnosis is simple. The recognition of the early stages, particularly of the anæsthetic form of the disease, may be extremely difficult. Attention has been drawn to this by Rogers and other authorities. It is held that leprosy is much more common than is supposed and that many patients die of an intercurrent disease when they are actually suffering from leprosy in an early stage. This was pointed out in 1896 by Dr. George Henry Taylor, when he was Medical Superintendent at the Coast Hospital, Little Bay, New South Wales. Dr. Taylor made it a practice to look for leprosy among the patients that came under his notice. In one patient who died of pleurisy, a diagnosis of leprosy in an early stage had been made, though none of the prominent signs were present. In three others who died of other diseases, examination of the spleen after death showed the presence of the bacillus of leprosy. The only certain method of determining the presence of the disease is by isolation of the *Bacillus leprœ*. Only by exhaustive examination and early diagnosis will the eventual eradication of leprosy be hastened.

THE TREATMENT OF SYPHILIS IN PREGNANT WOMEN.

The treatment of syphilis in pregnant women and its bearing on the incidence of congenital syphilis is a subject of the greatest importance. With the introduction of ante-natal care and treatment much is being done in this direction. A great deal of the effort, however, is isolated and want of coordination in methods and failure to review results from the standpoint of constructive criticism render much of the effort useless in the long run.

Among the workers in this particular field is Dr. J. Whitridge Williams. In 1920 he published a paper based on the study of 4,547 women whom he had observed over a period of four years and whose response to the Wassermann test he had studied. He found that syphilis was responsible for 34.4% of all the deaths occurring between the stage of viability of the fœtus and the end of the first two weeks of the puerperium. The introduction of efficient treatment in this series was the means of reducing the incidence of syphilis in children from 48.5% to 6.7%. Dr. Williams has published another report on a further series of patients whom he observed for a period of two years from January 1, 1920, to December 31, 1921.[1] During this time ninety-six women suffering from syphilis with one hundred and thirteen pregnancies passed through the hospital service. These patients were kept as far as possible under observation and in April and May, 1922, an attempt was made to follow up the histories of the children. By this means notes on the condition of the children were obtained for periods varying from four to twenty-eight months. In order to obtain greater accuracy, the treatment has been classified under several heads. Patients in Group "A" received at least six doses of "Diarsenol," followed by mercury and iodides. Treatment was continued until the blood failed to yield a reaction to the Wassermann test for a year after cessation of treatment. Group "B" comprised patients whose serum failed to yield a reaction to the Wassermann test for six months. Group "C" was composed of patients whose serum did the same for three months. Group "D" comprised patients whose serum failed to yield a reaction to the Wassermann test only shortly before the birth of the child. Group "E" was composed of patients whose treatment was ineffectual and whose serum did not reach the stage of failure to react. Of the one hundred and thirteen pregnancies, fifteen had ended in abortion or premature labour. Investigation showed that in all probability these were not due to syphilis. Of the ninety-eight children remaining, four had died of accidents and showed no syphilis at autopsy. Four were known to be syphilitic. Eighty-one were traced. One was syphilitic. Nine were clinically free from syphilis and the sera of the remaining seventy-one children failed to react to the Wassermann test. Dr. Williams points out that twenty-nine of the mothers belonged to Group "E" in regard to treatment. In other words, their treatment could not in any sense be regarded as satisfactory. Nineteen of their children, however, were alive and well and did not show any sign of reaction in the serum to the Wassermann test. In regard to the effects of treatment on the mothers, Dr. Williams points out that twenty-six mothers who were placed in Group "E" by their response to treatment, had had one hundred and three pregnancies before treatment with forty-six fœtal deaths. After treatment, which was not apparently very satisfactory, these same mothers had forty-eight pregnancies with six fœtal deaths.

In discussing the results of his work, Dr. Williams states that there is evidence that pregnancy seems to mitigate the virulence of syphilis. He quotes the observations of Wade Brown on animals that the pregnant female was much more resistant to inoculation with syphilis than the male or non-pregnant female. He maintains that such results are encouraging and stimulating in regard to future treatment.

[1] *Bulletin of the Johns Hopkins Hospital*, November, 1922.

Abstracts from Current Medical Literature.

THERAPEUTICS.

The Effect of Sodium Citrate on Blood.

Ralph A. Mellon, W. S. Hastings and Gertrude U. Casey (*The Journal of the American Medical Association*, November 11, 1922) have contributed to the literature of blood transfusion certain observations on the effect of sodium citrate on the blood. Numerous attempts have been made to account for the occurrence of more or less severe reactions after transfusion when careful preliminary tests had indicated complete compatibility of the blood of both donor and recipient. Probably sub-groups exist which are not discovered in the course of the recognized compatibility tests and this possibility, as well as the probable occurrence of anaphylactoid reactions from the injection of the foreign proteins of another individual's blood, may account for certain of these phenomena. But the interest of the authors was aroused by the frequent observation that the reactions occur more often when transfusion is performed with citrated blood than when it is carried out with unmodified blood. Is sodium citrate, they ask, toxic in itself? Do various samples of commercial citrate differ in their tendency to cause a reaction? If citrate is not in itself toxic, does it produce in its reactions with the transfused blood substances that are nocuous or cause other unfavourable changes in the blood? The purpose for which citrate is employed is to render calcium unavailable for the formation of thrombin. May there not be unintended side-reactions produced by the action of some samples of citrate or other salts on the proteins or even on the formed elements of the blood? The authors' attention was drawn forcibly to the last of these possibilities by the following experience. Blood was being transfused into a patient from a donor whose blood had been found compatible by means of cross-agglutination tests. While the blood was being injected, the patient collapsed so completely that for a time he was thought to be dead. The citrate was examined and was found to have a hydrogen ion concentration which was considerably on the alkaline side of neutrality (pH = 10.5). In the neutralization of this sample of citrate more acid was employed than was theoretically necessary to bring the solution from 10.5 to 8.0. This suggests that some impurity of an alkaline nature was present. The actual difference in titratable alkalinity between a pure citrate solution of pH = 8 and pH = 11.2 is very slight, since the titration curve between 8 and 11 is almost vertical, while from 5 to 8 it is relatively horizontal. If the citrate is pure, a pH value of 10.5 probably does not mean the presence of free alkali; but if, as in the sample, more than the theoretical amount of acid is required for neutralization, the sample is probably impure and a pH of 10.5 would be consistent with the presence of free alkali of some sort. The patient was later subjected to transfusion from the same donor with citrate buffered to maintain a hydrogen ion concentration approximately the same as that of the blood and no reaction occurred. The inference is therefore made that the reaction was due to the use of an unsuitable citrate solution. The authors do not doubt that moderately acid or alkaline solutions are quickly neutralized after injection into the blood stream. They maintain that the importance of the pH factor is probably associated with the disturbances of colloidal equilibrium which may accompany the rapid neutralization of solutions with an abnormal pH value.

Saturnine Compounds and Cell Growth.

W. Blair Bell (*The Lancet*, November 11, 1922) has recorded some observations on the influence of saturnine compounds on cell growth, with special reference to the treatment of malignant neoplasms. Phosphatids are apparently essential to the development of the nucleus and the growth of animal cells and to the physiological efficiency of important organs. These lipins are especially important for those body tissues in which nervous and growth-producing energies are stored and for those which are characterized by active cell multiplication and replacement. When lead is introduced into the organism lesions are produced in the nervous, genital and vascular systems. These changes are possibly due to a union of lead with the phosphatids contained in the cells concerned. It may then be argued that if lead combines with lecithin, this metal may be expected to influence the growth of tumours rich in these substances. Investigations by Bullock and Cramer have shown that rapidly growing tumours contain a greater proportion of lecithin (a lipin) than those of slower development and that sarcomata which grow more quickly than carcinomata, contain not only much more lecithin than is found in carcinomata, but also cerebrosides not present in epithelial growths. From these considerations the author was led to use saturnine preparations in the treatment of malignant neoplasms. Intravenous injections of a colloidal preparation of lead are not without danger, but with experience can be so regulated that little or no disturbance results. In nearly all instances lead appeared to arrest the growth of malignant tumours. In some instances the neoplasm entirely disappeared, with remarkable improvement in the general condition of the patients. The author recommends that, when possible, the bulk of the growth be removed and that the injections immediately follow while there exists an increased blood supply to the part. Previous intravenous injections of a colloidal preparation of lead increase the beneficial effect of X-rays, owing to the promotion of secondary radiation. Prophylactic treatment after complete surgical removal may be of considerable importance in the prevention of recurrence. While the author insists that the investigations are still in an experimental stage, he furnishes several instances of cure, chiefly in patients suffering from carcinoma of the breast and rectum.

Quinine Hyperglycæmia.

A. L. Latum and R. A. Cutting (*The Journal of Pharmacology and Experimental Therapeutics*, December, 1922) report experiments on rabbits with large doses of quinine. Fifty to two hundred milligrammes per kilogram of body weight were injected and blood sugar determinations made. They found that the blood sugar was definitely increased by one-half to one milligramme per cubic centimetre in normal rabbits, but that no increase of blood sugar occurred in rabbits whose splanchnic nerves had been cut. It was concluded, therefore, that hyperglycæmia due to quinine was produced by some mechanism of the central nervous system acting through the splanchnic nerves. It was also found that no hyperglycæmia was produced in rabbits subjected to left adrenalectomy and right splanchnotomy. The authors concluded that the adrenals played a part in producing quinine hyperglycæmia. They further found that quinine produced a rise in the alkali reserve. Epinephrine was tested in the same way and the authors consider that neither quinine nor epinephrine hyperglycæmia can be considered dependent upon acidosis.

Mercury.

The diuretic action of mercury compounds is the subject of an article by L. Blum and H. Schwab (*La Presse Médicale*, December 16, 1922). They point out the danger of giving mercury to some patients with cardiac dropsy and suggest the use of a compound called "Novasurol" in its stead. They have also studied the effect of mercury cyanide and have found that doses of 0.01 to 0.05 gramme of this substance given intravenously or intramuscularly have a very good effect as a diuretic and do not cause gastro-intestinal symptoms. They consider that "Novasurol" and mercury cyanide are contra-indicated in real dropsy because the diuresis which they produce, is always associated with an absolute and a relative decrease in the urea excreted. That is to say, the mercury causes retention of urea.

Adrenalin and Cocaine.

E. L. Ross (*Journal of Laboratory and Clinical Medicine*, October, 1922) publishes the results of a research on the effect of administering adrenalin and cocaine to dogs by hypodermic injection. An injection of 33.3% of a one in one thousand solution of adrenalin, 0.15 cubic centimetre per kilogram of animal weight, was made and was followed in five minutes by injection of 33.3% of a one in one thousand solution of adrenalin and 13.3% solution of cocaine. The adrenalin produced an increase in arterial pressure of 8%, in respiratory rate of 16%

and in amplitude of heart beat of 13%. The adrenalin and cocaine produced an increase of 233% in arterial pressure, 467% in venous pressure, 187% in amplitude of heart beat and 100% in respiratory rate. Morphine and atropine given before adrenalin and cocaine caused a less definite alteration in all the functions examined, but it was noted that two animals which had been given morphine and atropine died, whereas none of the other animals experimented with died. Sponging the pharynx with 20% solution of cocaine, followed by injection of adrenalin, was found to produce similar effects to adrenalin and cocaine injections, but the effects were less definite.

UROLOGY.

Adolescent Albuminuria in Nephroptosis.

A. H. PEACOCK (*Northwest Medicine*, November, 1922) has observed that a definite sagging of one or both kidneys is included in the clinical picture presented by a number of patients suffering from adolescent albuminuria. These observations were confirmed by pyelograms. It is suggested that an athletic habit or some injury accounts for many of the instances of dropped kidney. The majority of the patients under review had suffered from the mild eruptive fevers of childhood. Those who had had definite nephritis following scarlet fever, were not included in the series. It was particularly noted that the albuminuria was intermittent and that during any period of its occurrence the urine passed after a night of rest in bed was generally free from albumin. The author suggests that a sagging kidney produces some obstruction in the renal vessels with resulting renal congestion and the appearance of albumin in the urine. Casts are practically always absent and the renal efficiency tests give a normal result. The patients who submitted to nephropexy, showed improvement, as also did those who wore an abdominal binder.

Calcified Abdominal Glands.

J. THOMSON WALKER (*The Lancet*, December 9, 1922) has during the past few years examined forty-two patients suffering from urinary disease or supposed urinary disease in whom he found signs of calcified abdominal glands. Of these patients, thirty displayed X-ray shadows in the lower part of the abdomen on the right side or over the upper part of the sacrum (anterior and posterior ileo-colic groups), while in the remainder the shadows were seen in the upper part of the abdomen on the left side (mesenteric group). Some of the patients suffered from actual disease of the urinary tract, but in twenty-eight the calcified glands were apparently the only abnormality present. In twenty-five of these patients pain was the prominent feature and was often comparable in severity to a visceral colic. Movement had practically no effect on the pain and vomiting was absent. There was very rarely any bowel disturbance such as might be expected in the presence of appendicitis of long standing, although the skin tenderness was occasionally confused with that due to appendicitis. In seventeen of the twenty-five patients who complained of pain as the chief symptom, the clinical picture resembled that of renal or ureteral colic. The author regards this as probably having been due to the proximity of the glands to the ureter. Dragging or pressure on this duct would easily cause ureteric spasm. In six of the twenty-eight patients with enlarged glands as the only abnormality, blood was present in the urine. The use of pyelography and the opaque catheter with both antero-posterior and lateral pictures is of immense value in helping to distinguish the shadows which may be cast by calcified glands and in some cases by gall stones from those due to renal or ureteric calculi. This series of patients was composed almost exclusively of adults. Where definite and troublesome symptoms were caused, the calcified glands were removed through a paramedian incision and by blunt dissection.

Ureteric Stricture and So-Called Essential Hæmaturia.

G. L. HUNNER (*The Journal of the American Medical Association*, November 18, 1922) reports on the incidence of stricture of the ureter in association with so-called essential hæmaturia. Israel originally and Kretschmer later on proved that in the great majority of these instances nephritic changes were seen when the kidneys were obtainable for pathological study. The author believes that the nephritic changes are generally secondary to a unilateral or bilateral stricture of the ureter resulting from some distant focal infection. In treatment it is necessary not only to dilate the stricture, but to treat the original focus, if possible. Occasionally the kidney will become infected from a distant focus and hæmaturia occur in the absence of any ureteric lesion. In these circumstances treatment of the original focus alone will bring about a cure. Of eighteen patients treated by the author, ten have apparently been cured, three have improved and five still suffer from occasional recurrences of bleeding. It is possible that all the latter have still an uncured focus of infection.

Urography in Diagnosis.

J. H. MORRISSEY (*The Journal of the American Medical Association*, November 18, 1922) uses the term urography to cover the groups pyelography, ureterography and cystography. As an opaque medium a 20% solution of sodium iodide introduced with a syringe is the substance favoured by the author. The contra-indications to pyelography and ureterography are the presence of fever, age or infirmity of the patient, severe bleeding from the kidney and a tendency for suppression of the kidney function after ureteral catheterization. The enormous additional help in diagnosis afforded by pyelography is sufficient justification for its more extended use in a wider range of selected patients. A series of six hundred and sixty-one patients suffering from urinary conditions were examined by cystoscopy and pyelography. In only 25% was the diagnosis considered as fully established by ureteral catheter specimens. In almost 50% the diagnosis was concluded or firmly established by the pyelogram. In 12% the urogram was the means by which the kidney and ureter were excluded as the cause of the symptoms.

Nephrolysis and Ureterolysis.

G. KOLISCHER (*Journal of Urology*, August, 1922) declares that the operative removal of cicatricial tissue around the kidney or ureter, is usually successful in ridding the patient of various symptoms ascribed to compression or distortion of the affected organs. Fibrous peri-nephritis results from the resolution of an acute perinephritis or of an infected hæmatoma; the latter is usually the result of an injury. The renal area is the seat of permanent or intermittent dull aches, accentuated by the intake of overmuch fluid; there may be a history of previous focal infections or injury. The suspicion of peri-renal cicatrization is confirmed if the urine remains normal all the time, or if only during and just after the attacks cylindroids and red cells are to be found. A nephrolysis should never be considered complete unless, after freeing the body of the kidney, cicatrical compression in the region of the pedicle and pelvis is relieved. Distortion of the upper end of the ureter following peri-nephritis frequently calls for ureterolysis. Pyelography is invaluable in the diagnosis of this condition. With the cystoscope the intervals between the urinary jets appear prolonged on the affected side and the long interval is followed by a series of quickly repeated short jets, "delirium of the ureter."

Radium in Bladder Carcinoma.

A. J. SCHOLL AND W. F. BRAASCH (*Radium*, October, 1922) contend that, in flat, infiltrating growths of the bladder, the best results are obtained by partial resection of the bladder preceded by radium treatment. Small amounts are used with the object of inhibiting cell proliferation in isolated cells left *in situ* after operation. When operative removal is out of the question, large and completely destructive amounts of radium are employed. Unless the growth is on the anterior wall, small emanation tubes may be pushed into it through the Braasch direct cystoscope. The emanation tubes are left in the tumour. Fibrosis and walling off of the tumour tissue does not occur until the eighth or tenth day. After two weeks there is fusion of the normal cleavage planes and extensive œdema of the bladder wall, both of which increase the technical difficulty of operation. The optimum interval is therefore two weeks. For malignant papillomata the cystoscopic (or even operative) embedding of the tubes is impracticable on account of the loose nature of the growth.

British Medical Association News.

SCIENTIFIC.

A Meeting of the Victorian Branch of the British Medical Association was held in the Lecture Room at the Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne Hospital, on March 7, 1923, Dr. L. S. Latham, the President in the chair.

The Effect of Radium Rays on Living Cells.

Dr. Herman Lawrence read a paper on "Radium Therapy" (see page 463). He also exhibited microscopical preparations of the larval stage of *Demodex folliculorum*. The generally recognized hexapod form was displayed, as well as the "tadpole" form. The latter was not included in the common descriptions of the larvæ of *Demodekai*.

Professor W. E, Agar made some remarks on the question of prolongation of life as considered by Dr. Lawrence. He pointed out that cold-blooded animals were in a different category from the warm-blooded in regard to duration of life. In the latter the vital processes could neither be accelerated nor retarded, except within very narrow limits. In cold-blooded animals, however, external conditions, such as temperature, might affect the rate of metabolism enormously, so that such an animal at a low temperature would live at a much slower rate and consequently much longer than a similar animal at a high temperature. Probably the injurious rays of the radium acted in the same manner, namely, as a retarder of the vital processes and hence the term prolongation of life, while literally correct, did not seem to have the same significance as it would if applied to warm-blooded animals.

Professor Agar mentioned that Dr. Lawrence had treated a number of silkworms with radium for microscopical examination of the reproductive organs and that Mr. Greenwood was engaged in investigating this material at the Zoology Laboratory of the University.

Dr. Lawrence's explanation of unexpected sex conditions was not in accord with the views of zoologists in general. The conclusion drawn from a great bulk of evidence, both microscopical and experimental, was that sex in most animals was determined by the chromosomes. In mammals, for instance, the female had an even number of chromosomes, say, forty-eight (as was believed to be the case in man, though this determination was not so certain as for many other mammals). The ova, of course, had twenty-four chromosomes. In the male, however, the number of chromosomes was forty-seven and the reduction of the chromosomes in spermatogenesis resulted in the formation of two kinds of sperms in equal numbers, one class having twenty-four and the other twenty-three chromosomes.

A sperm with twenty-four chromosomes uniting with an ovum formed a zygote cell with forty-eight chromosomes, which therefore developed into a female, while a sperm with twenty-three chromosomes gave with the ovum a cell of forty-seven, which became a male. It was possible that the male had forty-seven ordinary and one very minute chromosome and that the male-producing sperm had this chromosome in addition to the twenty-three ordinary ones.

In *Lepidoptera*, on the other hand, the conditions were reversed, the male having the even number of chromosomes and the female an uneven number and producing two classes of ova. On this view of sex determination disturbances in the sex ratio were most easily accounted for by the hypothesis of a differential mortality in the two classes of sperms in man or of ova in the silkworm.

Passing to a consideration of artificial parthenogenesis Professor Agar said that it had long been known that silkworm eggs were liable to develope occasionally without previous fertilization. Indeed, a record of this had been published in 1795. It was, of course, a comparatively rare occurrence and an excess of parthenogenetic eggs from radiated moths over those from normal ones must be ascribed to the action of the radium.

The study of the artificial means of causing parthenogenetic development of eggs had reached a stage of great precision. Loeb had devised a chemical method which would cause practically 100% of sea urchin eggs to develope normally. In vertebrates parthenogenesis had been studied chiefly in the frog. Pricking unfertilized eggs with a very fine needle would cause a small proportion of them to develope.

A very interesting method of causing what amounted to parthenogenesis had been discovered by Hertwig. If the sperm of frogs were treated with an appropriate dose of radium they were weakened to a degree which allowed them to penetrate the egg, but not to fuse with the egg nucleus. The proof of this was afforded by a study of the nuclei of the embryos developing from such eggs, which showed that they had only half the number of chromosomes normally found in the frog.

Dr. H. Flecker said that Dr. Lawrence's paper had interested him very much and that he was so impressed with the value of radium that he recommended its use frequently in combination with deep X-ray therapy. With reference to the special action claimed for β rays, he might mention that Colwell and Russ considered the therapeutic effects of both γ and X-rays to be produced by secondary β rays or electrons in the tissues.

In several superficial lesions which failed to respond to radium treatment, he had obtained the desired result by intensive radiation with X-rays. He was glad to notice that Dr. Lawrence's experiments tended to show an absence of stimulating effect when X-rays were employed in small doses, but medical literature frequently implied such an effect for which there appeared to be very little evidence. It had even been suggested that such conditions as diabetes and impotence should be treated by the application of X-rays in small doses to the pancreas and testes respectively, but he considered it very doubtful that any degree of success was to be anticipated from such measures.

In regard to the question of heredity, Dr. Flecker referred to experimental work by Slye. This observer had been successful in breeding large numbers of mice which invariably developed cancer; further, she succeeded in breeding mice which could be relied upon to develope a particular variety of cancer in a particular organ. She was also able to breed other strains which never developed cancer. These results were completely at variance with the commonly accepted view that the transmission of cancer was not hereditary.

Dr. Lawrence had reviewed the results of an immense amount of work on his part and it was to be hoped that others would be induced to undertake research work in radiology. Despite its very great value in the treatment of various pathological states, radiology appeared to be a subject of such unimportance that those responsible for teaching at the Melbourne University had failed to provide a single lecture relating to it. The same might be said of the last post-graduate course and even the provisional programme of the Congress to be held in November, 1923, did not include this subject. It was to be hoped that some provision would be made for the discussion of deep X-ray therapy at least.

One considerable disadvantage which investigators and therapists alike suffered in Australia as compared with those in Europe and America, was the absence of a supply of radium emanation. It was a pity that this had not yet been forthcoming as by its means much might be accomplished. Thus, Barrenger, of New York, had been enabled to treat carcinoma of the prostate with much success by implantation of emanation needles directly through the bladder, rectum and perineum. Such a method of treatment could not be carried out in Australia.

Professor A. J. Ewart expressed the very great interest with which he had followed Dr. Lawrence's paper. The section in which Dr. Lawrence recorded his observations on the effects of radium emanations on the seeds of plants, interested him particularly. He was reminded of some work carried out about twelve years ago by Mr. Nightingall in the Botanical Laboratory of the University of Melbourne. This observer had determined that irradiation of the seed by radium induced a distinct acceleration of germination and growth in wheat, barley and oats. Some difficulty was experienced in ascertaining the optimum time of exposure, as it was found that the effect of irradiation for too long a period was to retard the process of germination.

As a further step some field experiments had been undertaken by which a radio-active mineral substance had been added to the wheat when planted, but the results had been disappointing. Further laboratory work had shown that radium emanations effected a temporary stimulus only; a prolonged exposure of the seed invariably resulted in retardation of growth. Thus what might have been a far-reaching agricultural possibility ended in results of no practical value.

The work embodied in Dr. Lawrence's paper opened up interesting problems in heredity. He wished to emphasize that it was important not to overlook plants in studies in heredity. Plants, indeed, should come first, as theirs was the simpler organization, but the tendency in recent years had been to focus attention on the very much more complex problems which arose among the sexually reproducing higher animals. To this fact he attributed the astounding dogma of complete separation of germ plasm and somato plasm, a principle totally inapplicable to plants. As an instance of the lesser degree of fixed reproductive specialization in plants he mentioned that parthenogenesis, which was not known in warm-blooded animals, was common in two of the larger genera of the *compositæ*, the highest group of flowering plants.

Some theories of heredity failed to account for the existence of graft hybrids in plants and this had led certain investigators to deny the existence of true graft hybrids or to explain them as being merely somatic mixtures of the cells of two individuals. A series of experiments were at present in progress at the Melbourne University to determine whether it was possible to produce graft hybrids in eucalypts and, if so, to investigate their real nature. It would take at least five or ten years to obtain results of any decisive value.

Dr. J. W. Dunbar Hooper, after expressing his thanks to Dr. Lawrence and the obligation of the Branch to Professors Agar and Ewart for their exceedingly interesting contributions to the discussion, said that he thought Dr. Flecker must have spoken under some misapprehension.

As a member of the Permanent Post-Graduate Committee, he could say that in the arrangement of the courses the Committee had taken great pains to ascertain the particular phases of work in which tuition was most desired and had then endeavoured to meet the demands. A special course in radiology to be held this year had already been arranged.

With reference to the provision made for radiology in the discussions at the forthcoming Congress, he could answer for the Section in which he was most interested; in that Section the subjects of radium therapy and deep X-ray therapy had been by no means overlooked, but had been given a prominence commensurate with their importance.

Dr. L. S. Latham said that all were greatly indebted to Dr. Lawrence, whose paper revealed original, prolonged and patient investigation. It could not fail to interest members, both for its bearing on therapeutics and for the appeal it carried to them as thinking men who were interested in the great problem of the latent possibilities of original cells.

He conveyed the thanks of the meeting to Professors Agar and Ewart for their very informative comments upon the issues raised by Dr. Lawrence.

NOTICES.

The Council of the Victorian Branch of the British Medical Association has arranged the following provisional programme of the Branch meetings. The Scientific Committee reserves to itself the right to modify the arrangements, but it is hoped that no changes will be necessary.

May 2, 1923.

At the Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne Hospital, at 8.15 p.m.

Dr. Keith Fairley: "Leucocytes in Health and Disease."

NOMINATIONS AND ELECTIONS.

The undermentioned have been elected as members of the New South Wales Branch of the British Medical Association:

Dalyell, Elsie Jean. O.B.E., M.B., 1909 (Univ. Sydney), 2, Macleay Street, Potts Point, Sydney.

Hardy, Ruth, M.B., Ch.M., 1922 (Univ. Sydney), c.o. Union Bank of Australia, Limited, 71, Cornhill, London, E.C., England.

Magill, David Wilson, M.B., Ch.M., 1922 (Univ. Sydney), Sydney Hospital.

Macdonald, William Morton Craig, M.B., 1921 (Univ. Sydney), c.o. Dr. R. McD. Bowman, Paddington.

Ryan, Harold Alexander, M.B., Ch.M., 1922 (Univ. Sydney), "Newland Court," Curlewis Street, Bondi.

Yates, Arthur Charles Kingsgate, M.B., Ch.M., 1922 (Univ. Sydney), c.o. Commercial Banking Company of Sydney, Limited, 18, Birchin Lane, London, E.C., England.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A Meeting of the Senate of the University was held on April 8, 1923.

Sir William Cullen was unanimously re-elected Chancellor for the ensuing three years and Dr. Cecil Purser was appointed Vice-Chancellor for the academic year 1923.

The following appointments and re-appointments *inter alia* were made:

Dr. H. R. G. Poate, Dr. S. Lightoller, Dr. N. D. Royle, Dr. B. P. Francis, Dr. T. Y. Nelson, Dr. D. J. Glissan, Dr. A. L. Buchanan, Dr. W. Roberts, Dr. Edna Smith, Dr. G. P. Mathews and Dr. R. B. Trindall as Honorary Demonstrators in Anatomy.

Dr. R. J. Silverton as Demonstrator in Anatomy.

Mr. C. J. Cahill as Demonstrator in Pharmacy.

Dr. M. S. Allan as Demonstrator, Faculty of Dentistry.

On the recommendation of the Faculty of Science, Mr. Francis Lions was nominated to the Commissioners of the Exhibition of 1851 for a Science Research Scholarship for 1923. Mr. Lions's academic record showed him to be a student of conspicuous ability. After gaining a very high pass at the Leaving Certificate Examination in November, 1918, Mr. Lions was awarded an exhibition in the Faculty of Science. At the First Year Examination he was awarded the Levey Scholarship for Chemistry and Physics, at the Second Year Examination the Caird Scholarship for Chemistry II. and the Deas Thomson Scholarship for Physic II.. He obtained first-class honours at graduation and was awarded the University Medal for General Chemistry and the University Medal for Organic Chemistry.

On the recommendation of the Professorial Board it was decided that: (*i.*) The University should revert to the previous system of three academic terms of ten weeks' duration after 1923. (*ii.*) That the conditions of award of the Bloomfield Scholarship (awarded by the Repatriation Department) be announced and that applications be invited from those coming within the terms of the scholarship.

The following Committees were appointed:

Finance: The Chancellor, Vice-Chancellor, Warden, Judge Backhouse, Sir Henry Braddon, Mr. Justice Street, Mr. F. Leverrier, Mr. S. H. Smith.

Buildings and Grounds: The Chancellor, Vice-Chancellor, Warden, Judge Backhouse, Mr. J. J. C. Bradfield, Dr. G. H. Abbott, Mr. J. Nangle, Mr. Leverrier and Professor Warren.

Organ: The Chancellor, Vice-Chancellor, Warden, Judge Backhouse, Professor Fawsitt, Mr. Justice Street and Mr. W. A. Miller.

By-Laws: The Chancellor, Vice-Chancellor, Warden, Judge Backhouse, Sir Joseph Carruthers, Mr. Justice Ferguson, Mr. F. Leverrier, Mr. D. Levy, Professor Peden, Mr. A. B. Piddington and Mr. Justice Street.

Committee of Management, Biological Station: The Dean of the Faculty of Science, The Professor of Botany, The Professor of Zoology and Professor Haswell.

Correspondence.

THE USE OF THE TOOTH BRUSH.

Sir: For some years I have recommended the following method:

A.—(1) Choose a very stiff brush, preferably one whose bristles project at the heel about one-eighth of an inch beyond the general level and at the toe about one-quarter of an inch.

(2) Mix ten drops of soapy cresol (*liquor cresol saponatus*) in a tumblerful of water.

(3) Soak the brush in this for several hours.

B.—Clean the teeth night and morning and, if convenient, after all meals, thus:

(1) Remove the brush from the dilute soapy cresol; rinse it with water.

(2) Take a little water into the mouth and brush briskly.

(3) Brush all parts of the teeth, up and down as well as across. If this do not remove all food from between the teeth, use a blunt toothpick.

(4) Use no tooth paste.

(5) If plain water do not cleanse sufficiently, pour three drops of peroxide of hydrogen on the damp, rinsed brush and use it.

(6) Rinse the mouth with water.

(7) Rinse the brush with water and replace it in the dilute soapy cresol; leave it there till you next use it.

The constant soaking keeps the brush clean and sweet and so soft that it won't injure the gums, even if they are rubbed strongly.

The brush will last longer than if allowed to dry.

One tumblerful of dilute soapy cresol will last for weeks.

Yours, etc.,

F. Guy Griffiths.

131, Macquarie Street, Sydney,
April 7, 1923.

Books Received.

SPECTACLES AND EYE GLASSES: THEIR FORMS, MOUNTING AND PROPER ADJUSTMENT, by R. J. Phillips, M.D.; Fifth Edition, Revised; 1923. Philadelphia: P. Blakiston's Son & Company; Post 8vo., pp. xii. + 89, with 61 illustrations. Price: $1.50.

Medical Appointments.

Dr. S. F. McDonald (B.M.A.) has been appointed Honorary Visiting Medical Officer at the Baby Clinic, West End, Brisbane.

* * * *

Dr. J. J. Harris (B.M.A.) has been appointed Deputy Commissioner of Public Health, Queensland, during the absence of the Commissioner of Public Health.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xviii.

Austin Hospital, Heidelberg: Assistant Resident Medical Officer.

Melbourne Hospital: Resident Radiologist.

Renwick Hospital for Infants, Sydney: Honorary Dermatologist.

Sydney Hospital: Honorary Assistant Physician and Honorary Relieving Assistant Physician.

Medical Appointments: Important Notice.

Medical practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429, Strand, London, W.C.

BRANCH.	APPOINTMENTS.
New South Wales: Honorary Secretary, 30 - 34, Elizabeth Street, Sydney	Australian Natives' Association Ashfield and District Friendly Societies' Dispensary Balmain United Friendly Societies' Dispensary Friendly Society Lodges at Casino Leichhardt and Petersham Dispensary Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney Marrickville United Friendly Societies' Dispensary North Sydney United Friendly Societies People's Prudential Benefit Society Phœnix Mutual Provident Society
Victoria: Honorary Secretary, Medical Society Hall, East Melbourne	All Institutes or Medical Dispensaries Australian Prudential Association Proprietary, Limited Manchester Unity Independent Order of Oddfellows Mutual National Provident Club National Provident Association
Queensland: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane	Brisbane United Friendly Society Institute Stannary Hills Hospital
South Australia: Honorary Secretary, 12, North Terrace, Adelaide	Contract Practice Appointments at Renmark Contract Practice Appointments in South Australia
Western Australia: Honorary Secretary, Saint George's Terrace, Perth	All Contract Practice Appointments in Western Australia
New Zealand (Wellington Division): Honorary Secretary, Wellington	Friendly Society Lodges, Wellington, New Zealand

Diary for the Month.

May 2.—Victorian Branch, B.M.A.: Branch.
May 3.—Queensland Branch, B.M.A.: Branch.
May 8.—New South Wales Branch, B.M.A.: Ethics Committee.
May 9.—Western Australian Branch, B.M.A.: Council.
May 9.—Melbourne Pædiatric Society.
May 11.—New South Wales Branch, B.M.A.: Clinical Meeting.
May 11.—Queensland Branch, B.M.A.: Council.
May 11.—South Australian Branch, B.M.A.: Council.
May 15.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
May 15.—Illawarra Suburbs Medical Association, New South Wales.
May 16.—Western Australian Branch, B.M.A.: Branch.
May 17.—Victorian Branch, B.M.A.: Council; Election for Representative Body.
May 17.—City Medical Association, New South Wales.
May 22.—New South Wales Branch, B.M.A.: Medical Politics Committee; Organization and Science Committee.
May 24.—Brisbane Hospital for Sick Children: Clinical Meeting.
May 25.—New South Wales Branch, B.M.A.: Branch.

Editorial Notices.

Manuscripts forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to The Medical Journal of Australia alone, unless the contrary be stated.

All communications should be addressed to "The Editor," The Medical Journal of Australia, B.M.A. Building, 30-34, Elizabeth Street, Sydney. (Telephone: B. 4635.)

Subscription Rates.—Medical students and others not receiving The Medical Journal of Australia in virtue of membership of the Branches of the British Medical Association in the Commonwealth can become subscribers to the journal by applying to the Manager or through the usual agents and book-sellers. Subscriptions can commence at the beginning of any quarter and are renewable on December 31. The rates are £2 for Australia and £2 5s. abroad *per annum* payable in advance.